EIP-SCC
European Innovation Partnership on Smart Cities and Communities

NTNU

Marketplace of the European Innovation Partnership
on Smart Cities and Communities Action Cluster
Integrated Planning/Policy and Regulation

Smart City Guidance Package

A Roadmap for Integrated Planning and Implementation of Smart City projects

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European Commission

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Disclaimer

CONTENTS

LIST OF ACRONYMS

AIT:	Austrian institute of Technology
BAU:	Business as usual scenario
BEI:	Baseline Emission Inventory
BIM:	Building Information Model
BSI:	British Standard Institutions
CAPEX:	Capital Expenditures
CEM:	Customer Experience Management
CEN:	European Committee for Standardization
CENELEC:	European Committee for Electrotechnical Standardization
CHP:	Combined Heat Power
CMS:	Content Management System
CoM:	Covenant of Mayors for Climate and Energy
CoP:	Conference of Parties
eea:	European Energy Award
EC:	European Commission
EEA:	European Environmental Agency
EIP-SCC:	European Innovation Partnership for Smart Cities and Communities
ESOs:	European Standardisation Organisations
ESCO:	Energy Service Company
ETSI:	European Telecommunications Standards Institute
EU:	European Union
FP9:	Framework Programme 9
GDP:	Gross Domestic Product
GDPR:	General Data Protection Regulations
GHG:	Green House Gas
GIS:	Geographical Information System
H2020:	Horizon2020
IAO:	Fraunhofer-Institut fur Arbeitswirtschaft und Organization
ICT:	Information and Communication Technology
IoE:	Internet of Everything
IoT:	Internet of Things
IPPR:	Integrated Planning, Policies and Regulation
IT:	Information Technology
ITS:	Intelligent Transportation System
JPI:	Joint Programming Initiative

JRC:	Joint Research Center
KIC:	Knowledge and Innovation Communities
KPI:	Key Performance Indicators
MADM:	Multiple Attribute Decision Making
NGO:	Non-Governmental Organization
NTNU:	Norwegian University of Science and Technology
OPEX:	Operational Expenditures
PB:	Participatory Budgeting
PCP:	Pre-Commercial Procurement
PPI:	Public Procurement of Innovation Solutions
PPP:	Public Private Partnership
PSC:	Public Sector Comparator
PV:	Photovoltaic
RES:	Renewable Energy Systems
ROI:	Return On Investment
RTO:	Research and Technology Organisation
SaaS:	Software As a Service
SCGP:	Smart City Guidance Package
SCIS:	Smart Cities Information System
SDGs:	Sustainable Development Goals
SEAP:	Sustainable Energy Action Plan
SEC:	Smart Energy City
SECAP:	Sustainable Energy and Climate Action Plan
SET:	Strategic Energy Technology
SMEs:	Small and Medium Enterprises
SUMP:	Sustainable Urban Mobility Plan
SWOT:	Strength Weaknesses Opportunities Threats
TNO:	Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek
UDP:	Urban Data Platform
UN:	United Nations
VTT:	Technical Research Centre of Finland

FOREWORD

The Smart City Guidance Package (SCGP) helps to plan and implement smart city and low energy district projects in an integrated way by describing common situations and giving real-life examples. It bundles the generously shared experiences and expertise of cities, businesses, citizens, research institutes and Non-Governmental Organisations (NGOs) that work together in the European Innovation Partnership Smart Cities and Communities (EIP-SCC).

Across the world, many cities and urban stakeholders have the ambition to create sustainable cities, adjusted to the era of digitalization, which are pleasant to live in. The wealth of urban data, the increased connectivity of urban objects through the Internet-of-Things (IoT) and advanced ICT, energy and mobility technologies, have opened new avenues for the application of smart solutions and the transition to clean energy and mobility systems in cities. Cities are looking into this potential, experimenting in living labs and applying smart technologies in ambitious integrated projects, such as the Horizon2020 SCC-01 lighthouse projects.

However, our current approaches to the integrated planning and management of smart city and low energy district projects are not sufficiently taking into account the full life-cycle of planned investments in the built environment, and the entire community influenced by them. This requires a genuine long-term perspective beyond the political cycle at the heart of any smart city or low energy district strategy, more inclusive participatory and consultation processes, novel business models and better collaboration within and across traditional policy and administrative boundaries. If these conditions are not in place, projects might be difficult to prepare and implement, underperforming in terms of reduction of CO_2 and energy use, or not valued by end-users.

As explained in the Strategic and Operational Implementation Plans of the EIP-SCC, **Integrated Planning and Management** involves spatial, temporal and technical coordination of diverse policy areas and planning resources to achieve defined goals using specified (financial) instruments. Its success requires the comprehensive and early involvement of all governmental and non-governmental players, private sector, and citizens. This is particularly challenging as it involves managing long-term planning perspectives and short-term actions, addressing domains as diverse as transport, energy, ICT and beyond – in both existing (retrofit) and new urban territory. The aim of the SCGP is to explain how such integrated planning and management can be realised, with which instruments.

This SCGP guides cities and urban stakeholders by bundling experiences and best practices of cities working on ambitious smart city strategies and projects. An increasing wealth of information on innovative, integrated planning and management is available in the form of lessons-learnt in Smart City Framework 7, CONCERTO and Horizon2020 projects, stored in and disclosed by the Smart City Information System (SCIS). The SCGP makes this information available to others in a summarised condensed form. It provides an easily accessible roadmap for developing and realising integrated smart city and low energy district plans in a sequence of stages and explores what it takes to scale-up and replicate. City administrations that want to implement smart city plans and projects will benefit by learning from the successes and issues of others.

In addition, **the SCGP offers inspiration** to cities and urban stakeholders who have the ambition to start developing and implementing their own smart city projects in the nearby future, and want to orient themselves on **what to expect and prepare beforehand** with respect to integrated planning and management.

In the EIP-SCC, the Action Cluster of “Integrated Planning/Policy and Regulation” (IPPR) focuses on what is needed to plan and manage smart city projects in an integrated way. In the EIP-SCC Strategic Implementation Plan from 2013 and the Operational Implementation Plan from 2014, specific actions were recommended for integrated planning and management and for policy and regulation to respond to this challenge. For instance, improving collaborative governance at city-scale or higher, and maximal use of city-wide data for a more dynamic and informed planning process combining both shorter and

longer time horizons. In addition, using urban simulation models to demonstrate impacts of urban development that can be linked to urban operational systems, and the use of multi-sectorial energy models and mapping at district and city scale, were advocated. Further, it was recommended to improve engagement of stakeholders through visualisation and decision support tools and develop innovative governance forms for integration of different stakeholders. Finally, identification and mapping of conflicts/gaps/hurdles and training and education for city stakeholders were thought very useful, next to encouraging cities to develop smart city plans and implement them, thus enforcing cross-domain thinking in policies.

The SCGP follows up on these suggestions and makes them concrete by providing a roadmap for integrated planning and implementation. Cities, industry, NGOs and knowledge partners have collaborated on its content: experiences in integrated planning and implementation of smart city projects, their upscaling and replication afterwards to achieve an urban transition, and the role of monitoring, Key Performance Indicators (KPI's) and tools in this process.

This guide builds upon the experiences of commitments in the Action Cluster Integrated Planning, interviews with key players in the field, project information generously shared by Smart City projects in Framework Programme 7 and Horizon2020, and the Smart City Information System (SCIS). It helps to prepare the next generation of smart city projects and to involve new cities and urban stakeholders within and outside the EIP-SCC. In this way, it paves the way for further market uptake of smart solutions across Europe. In addition, it can support a wide variety of other, related policies and initiatives, such as:

- The Urban Agenda
- The Energy in Buildings and Community Programme of the International Energy Agency
- Urban Innovation Actions
- Cities participating in the European Energy Award (eea)
- The Covenant of Mayors for Climate and Energy
- Climate KIC projects focusing on cities,
- Any local or regional smart cities initiative

The SCGP hopes to contribute to better policy and decision making and its implementation, by informing **both the political level of local governments** and its strategists and advisers, **and the operational level**, such as directors of units, technical staff, and project managers of Smart City projects.

HOW TO USE THIS GUIDEBOOK?

Integrated planning and implementation of smart city and low energy district projects often require a different approach and philosophy, and different methods and different instruments, to realise their aims. For instance, by far more inclusive participatory and consultation processes, and greater collaboration within and across traditional policy and administrative boundaries within and between cities and communities. As smart city plans and projects have other needs, standard practices from traditional project management are often not entirely satisfactory. This guidebook supports local governments and other urban stakeholders during different stages of preparation, implementation and replication of any smart city strategy and plan. This is done by pointing out what should be done in each stage, which issues might turn up and which solutions have worked well in other cases.

The EIP-SCC Action Cluster Integrated Planning and Management has investigated how smart city and low energy district strategies are developed and projects planned, and compiled the outcomes with the aim of guiding a city through this process. This guidance material focuses not on information about specific technologies, but on how to organise the „soft shell" around implementation of these smart city and low energy district technologies. It is meant to serve as a self-help guide, getting city administrations started, and preceding the bigger work.

City administrations and urban stakeholders learn more about the main stages in the process of integrated planning and management, find best practices and examples, and are advised how to avoid common barriers. After a brief sketch of the smart city and low energy districts landscape, the various stages in the preparation and realisation of smart city and low energy district projects are discussed in more detail using checklists of to do's. As a sound financial basis and co-design and co-creation are critical for successful preparation, planning and implementation of any smart city or low energy district project, various financial instruments and methods for engagement of citizens and local businesses are presented. Urban data and ICT help to gain insight into the impact of different options beforehand, and to track the progress of the actions defined in a smart city plan during its implementation. The guide discusses various frameworks for defining the needed KPI's, and the ICT tools supporting impact assessment and track of progress. Finally, the guide explores various accelerating actions that can help to achieve more impact locally through replication and upscaling in cities.

Its added value for city administrations consists of:

- Aligning city administration and its key stakeholders;
- Help to make the first steps, for instance by serving as a basis for technical assistance and supporting the development of more detailed plans and projects;
- Providing support for the project manager responsible for setting up integrated projects;
- Improve the knowledge level of staff by educating on long-term perspectives and cross-domain collaboration with citizens, businesses, research and NGOs.

To provide direct references per stage about good practices and examples, the references are grouped per chapter and can be found at the end of this document.

This guide is meant to serve both as an inspirational and an informational self-help guide. It looks at integrated planning and management of smart city and low energy district projects predominantly through the eyes of cities' strategists, experts and project managers. It aims to explain:

WHAT is integrated planning and management of smart city projects?

WHY do cities need methods for integrated planning and management?

HOW to develop a smart city strategy and who to involve?

WHICH tasks can be expected and how to deal with them?

WHERE can you find information on financial instruments?

HOW to engage stakeholders and keep them engaged during different phases of implementation?

HOW can KPI's and tools help to evaluate alternatives and track progress?

WHICH actions can help to accelerate the impact towards an urban transition?

introduction

WHY DEVELOP SMART CITY STRATEGIES AND IMPLEMENT SMART CITY PLANS?

Challenges for cities

Nowadays, more than 60% of the 7.5 billion inhabitants live in cities. Cities contribute to 70% of our world economy, and while they cover only 2% of the total land, they have a big impact on sustainability: 60% of the energy is consumed and 70% of both GHG and waste are generated in cities.

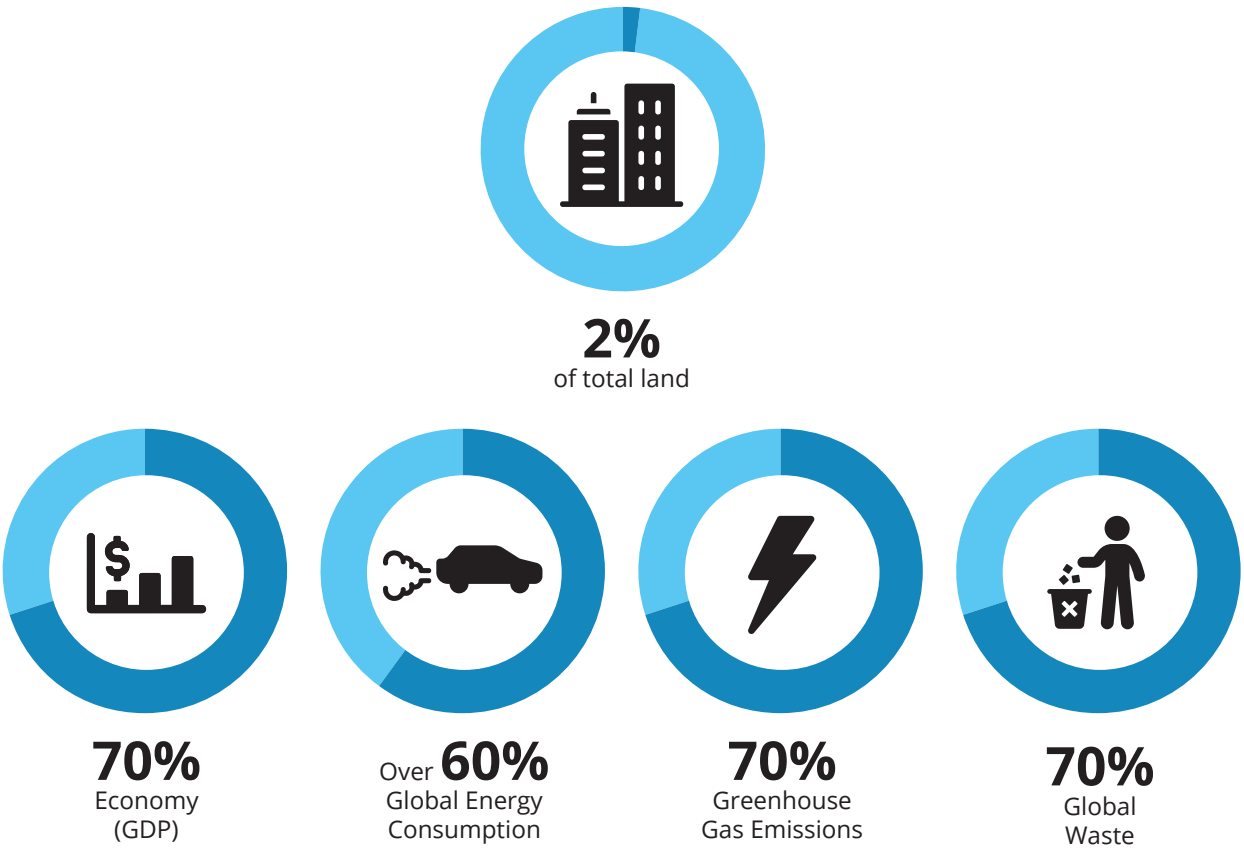


Figure 0-1. Impact of cities Source: United Nations Sustainable Development Goals, press release June 2017

By 2050, we expect over 10 billion inhabitants, of which close to 80% will live in cities. The challenge that every city is facing, is how to best deliver the facilities and services needed to ensure a thriving population and good economic performance in a sustainable manner. This is a huge challenge for cities and communities, especially when considering that decisions made on infrastructures and the built environment today, will have a lasting impact on the cities for several decades.

Pressing urban issues in Europe are:

- Lack of progress in the transition to clean, affordable and secure energy systems and circular economies, while keeping a healthy economic basis of local economies. As a result, the adverse effects of climate change and pollution are insufficiently combatted;
- Lack of protection of biodiversity, national and cultural heritage, and identity of areas, not only in Europe, but also in other parts of the world, as both directly and indirectly affected by European consumption and urbanisation;

Figure 0-2 All 17 Sustainable Development United Nations. Source: www.un.org/sustainabledevelopment/Goals

- Congested, crowded and cluttered cities, in particular regarding mobility and accessibility, poor quality of local living environment and public space, and unaffordable housing;
- Social polarisation as a result of globalisation and migration, ageing and lack of intergenerational justice, manifesting itself in less social connections, unsafety and insecurity, deprivation, erosion of communities, high costs of health care;
- Economic competitiveness of European cities, now and in the future;
- Lack of overview of what new ICT technologies might mean for European cities and their citizens (robotisation, further digitisation, autonomous vehicles etc.).

Global and European responses to urban challenges

To address the challenges cities face, several reference frameworks and strategies with ambitious targets have been adopted at global and European level. UN Habitat and UN Sustainable Development Goals (SDGs) are among these reference initiatives, committed by many countries and by the European Commission (EC).

UN Sustainable Development Goals

On 1 January 2016, the world officially started the implementation of the 2030 Agenda for Sustainable Development—the transformative plan of action based **on 17 SDGs** —to address urgent global challenges over the next 15 years. This agenda builds on the success of the Millennium Development Goals and wants to ensure sustainable social and economic progress worldwide. It seeks to integrate and balance the three dimensions of sustainable development economic, social and environmental—in a comprehensive global vision. The SDGs with their 17 goals and 169 targets address critical issues the world faces today, such eradicating extreme poverty, tackling global inequality and climate change, promoting sustainable urbanization and industrial development, protecting natural ecosystems, and fostering the growth of peaceful and inclusive communities and governing institutions. To support the implementation of the SDGs, a set of 231 indicators has been developed to measure progress on goals

and targets, within and across countries. While SDG 11 explicitly addresses sustainable cities and communities, cities' strategies often also address many other SDGs, thus contributing significantly to meeting a wide range of the SDGs. The 17 SDGs are:

The **UN Sustainable Development Goals** are a call for action by all countries to promote prosperity while protecting the planet. They acknowledge that ending poverty must go hand-in-hand with strategies that build economic growth and address a range of social needs including education, health, social protection, and create job opportunities, while tackling climate change and environmental protection.

For cities and communities - **Goal 11** – the objective is to make cities inclusive, safe, resilient and sustainable. To meet the targets, there is a need to take an active interest in the governance and management of the city, to identify what works and what doesn't, and to develop a vision for its buildings, streets, and neighbourhoods, and act on that vision. Developments in jobs, healthcare, safety and security, mobility, air quality, quality of life, shared public spaces, quality of life are all interrelated, and concerns about them motivate city administrations to meet SDG11. In that sense, an efficient holistic management approach for creating a vision for implementing and improving action plans, with relevant KPI's is an efficient manner to meet the objectives and improve the global quality of life.

This endeavour is supported by UN-Habitat, the United Nations programme working on a better urban future. As its mission is to promote socially and environmentally sustainable human settlements development and providing adequate shelter for all, UN Habitat supports the development of holistic and global approaches towards urbanization, which pave the way to meeting UN SDGs. To support the practical implementation of the SDGs by providing a concrete methodology, the International Standardization Organisations develop standards as practical tools for meeting them, among them ISO TC 268 (sustainable cities and communities) with its 371xx series of standards.

EU policies related to smart cities and low energy districts

In the EU, smart city policies are anchored in several directives and agreements. At first the **Strategic Energy Technology** (SET) **plan** (EC, 2017). At second, in the **goals for energy savings, clean energy production, low emission mobility and logistics, and climate change mitigation** for 2020, 2030 and 2050 (EC, 2010a, 2012, 2016a and 2016b). The ambition to realise a low carbon economy in Europe, has been translated in Europe wide objectives of a reduction of GHG emission from 20% to 80-95%, an increase in the share of renewable energy sources in energy consumption from 20% to 80-95%, and an increase in energy savings of 20% to 80-95%, between 2020 and 2050 as compared to 1990..This requires that both building stock and physical infrastructures are deeply renovated, transformed, used and operated in a fundamentally different way. Advanced, interoperable ICT solutions combined with the wealth of urban data offer new possibilities to (re)design and operate cities in a smart and sustainable way, thus linking smart city policies to the Digital Agenda for Europe (EC, 2010b).

Experiences from successful earlier programmes, such as **CONCERTO** and **CIVITAS**, have been very important for further articulation of EU smart city policies. CONCERTO has proved in 53 pilots that a district-based approach to deep refurbishment and clean energy can deliver more than 50% reduction in energy consumption and GHG emission with a viable business case (EC, 2014). CIVITAS has amply demonstrated the feasibility of sustainable transport solutions. Subsequently, more integrated, cross-domain smart city projects have been part of the Framework Programme (FP) 9 and Horizon2020 SCC-01. The first generations of these lighthouse projects as Triangulum, SmarterTogether and REMOURBAN, have now successfully implemented plans integrating smart transport, smart buildings and smart infrastructures, usually in a specific district. Beside the aforementioned CONCERTO, CIVITAS, FP9 and Horizon 2020 projects and programmes, a host of other excellent projects, programmes, initiatives and networks have contributed to low energy districts and smart cities in the EU, for example **C40, Eurocities, ICLEI, Covenant of Mayors for Climate and Energy, 100 Resilient Cities**, and **EIP-SCC**. A learning environment has been created, where knowledge, best practices, and lessons learnt are shared and jointly brought to the next level.

In addition, the **Urban Agenda for the EU** was launched in May 2016 with the Pact of Amsterdam. It represents a new multi-level working method promoting cooperation between Member States, cities, the European Commission and other stakeholders, in order to stimulate growth, liveability and innovation in the cities of Europe and to identify and successfully tackle social challenges. The Urban Agenda focuses more specifically on three pillars of EU policy-making and implementation: **better regulation**, **better funding, and better knowledge.**

As stated in the **Pact of Amsterdam** the Urban Agenda for the EU has four main objectives:

- It aims to realise the full potential and contribution of urban areas towards achieving the objectives of the Union and related national priorities in full respect of subsidiarity and proportionality principles and competences;
- It strives to establish a more effective integrated and coordinated approach to EU policies and legislation with a potential impact on urban areas and to contribute to territorial cohesion by reducing the socioeconomic gaps observed in urban areas and regions;
- It will not create new EU funding sources, unnecessary administrative burden, nor affect the current distribution of legal competences and existing working and decision-making structures and will not transfer competences to the EU level (in accordance with Articles 4 and 5 of the Treaty on European Union);
- It strives to involve urban authorities in the design of policies, to mobilise urban authorities for the implementation of EU policies, and to strengthen the urban dimension in these policies. By identifying and striving to overcome unnecessary obstacles in EU policy, the Urban Agenda for the EU aims to enable urban authorities to work in a more systematic and coherent way towards achieving overarching goals. Moreover, it will help make EU policy more urban-friendly, effective and efficient.

At present 14 partnerships are active: from climate adaptation, sustainable land use, energy transition and air quality to urban mobility. Several cities developing smart city processes and projects are also involved in the realisation of the Urban Agenda.

March 2019 the inter-institutional trialogue has adopted both proposals for a Regulation of the European Parliament and of the Council of Europe, establishing “Horizon Europe - Partial General Approach” and the proposal for a Decision of the Council on establishing the specific programme implementing “Horizon Europe – the Framework programme for Research and Innovation”. In this context, one of the five missions will focus on “Climate Neutral and Smart Cities” and be based on a bottom-up approach involving all types of stakeholders.

European and global collaborations on smart cities and low energy districts

This section sketches the broader landscape of European initiatives, activities in the fields of smart cities and low energy districts, in particular the EIP-SCC, Covenant of Mayors, and European Energy Award.

European Innovation Partnership on Smart Cities and Communities

The EU’s goals for energy savings, clean energy production, low emission mobility and logistics, mitigation of climate change and digital inclusion, provide the context for the EIP-SCC. The EIP-SCC, established in 2012 as an initiative from of the EC, has strived to build a broad community of cities, industries, Small and Medium Enterprises (SMEs), banks, knowledge institutes, citizens, NGOs, and other smart city actors. It intends to improve citizens’ quality of life and reach energy and climate targets, while increasing the competitiveness of Europe’s industry and innovative SMEs.

Knowledge sharing to prevent the repetition of mistakes and facilitating connections between people and solutions are essential to achieve these goals. To this end, the EIP-SCC Market Place brings together those who are active in the field of Smart Cities and willing to know more about ongoing and foreseen activities throughout Europe. Networking, exchange of information, partnering and matchmaking help to develop and implement smart city and low energy district solutions at the intersection of energy, ICT and transport. The EIP-SCC plays a central role in shaping the preconditions for market acceleration and prepare new deals in the near future.

In general, smart city and low energy district plans and projects have four overall objectives:

- make the city more liveable and sustainable, and realise a better quality of life
- use the increasing volume of urban data and connectivity, next to advanced ICT, to adjust to the city to the era of digitisation
- provide better services to citizens and local businesses
- generate local economic growth through new business opportunities and start-ups

These objectives are met by using smart city and low energy district solutions. Solutions are understood here to include not only technologies, but also specific methods. The most common technologies are summarised in Table 0-1.

EIP-SCC Action Cluster on Integrated planning, policy and regulation

Within the EIP-SCC, the Action Cluster of Integrated Planning/Policy and Regulation focuses on **what is needed to plan and manage smart city projects in an integrated way**. More specifically, in the initiative "From Planning to Implementation and Upscaling of Smart City Projects", cities, industry, NGOs and knowledge partners collaborate on the exchange of experiences in the integrated planning and implementation of smart city projects, and their upscaling and replication afterwards to achieve the urban transition to smart and sustainable cities on an increasing scale across Europe.

SCIS

EIP-SCC and the initiatives and commitments of the Action Cluster IPPR partner with SCIS since the launch of the EIP-SCC. One of the main aims is to consider the outcomes of all projects considered by SCIS to feed EIP-SCC AC IPPR with inputs for promoting and branding integrated planning approaches within the cities and community networks. In addition, EIP-SCC AC IPPR has organised with SCIS several workshops, gathering inputs from EC DGs, and major cities networks, i.e. European Energy Award, EUROCITIES, Covenant of Mayors, Climate Alliance. One common aim is to provide guidance to best meet our EU targets as well as UN SDGs objectives.

The Covenant of Mayors for Climate and Energy

The Covenant of Mayors for Climate and Energy - Europe is the initiative by which European towns and cities voluntarily commit to reducing their CO_2 emissions and adapt to climate change. This formal commitment is to be achieved through the implementation of Sustainable Energy (and Climate) Action Plans (SEAPs or SECAPs). The purpose of the present guidebook is to help the signatory municipalities to achieve the commitments they have taken on by signing up to the initiative, in particular to prepare a SECAP within two years following their official adhesion, which includes:

PARTS OF BUILT ENVIRONMENT	TYPICAL SMART CITY AND LOW ENERGY DISTRICT SOLUTIONS
Residential, buildings; **Commercial, social,** **educational,** **medical** **buildings;** **Industry buildings and installations**	Low-, zero- and positive energy construction and refurbishment technologies, installations and appliances, e.g. thermal insulation, passive houses, heat recovery from ventilation; Integration with renewable energy production; Making buildings more intelligent through sensors, actuators and interoperable ICT, smart meters; Creating uni- or bi-directional charging infrastructures for electric vehicles as cars and bikes; Providing collective solutions for energy supply, such as solar plants, geothermal or district heating; Make operation and use of the building smarter, e.g. through sensorised smart lighting; Using clean mobility and logistics solutions to provide transport, e.g. electric vehicles, smart parking, clean "last mile" in logistics, Applying principles or smart (re)design, integrated planning and implementation at district level, e.g. based on holistic energy and transport designs which have been co-designed with stakeholders; Smart process technology in industry, e.g. allowing re-use of excess heat and by-products as hydro
Infrastructures	Enable smart operation and use of the infrastructures with sensors and actuators, other urban data and ICT, i.e. intelligent transport systems; Smart thermal and electric grids, virtual power plants; Enable exchanges, conversion and co-production of energy, e.g. with data centres, or using combined heat power (CHP); Adding sensors and actuators to the physical infrastructures, Smart Lighting; Organise interoperability between physical infrastructures and buildings through protocols, standards, e.g. Internet of Things, Internet of Everything; Organise smart operations, smart (re)design and improved/novel services to citizens through urban platforms

Table 0-1: Typical smart city solutions applied in the built environment. Source: Borsboom-van Beurden (2018b)

- a Mitigation & Adaptation strategy
- a Baseline Emission Inventory (BEI)
- a Mitigation Action plan
- a Risks and Vulnerability Assessment
- an Adaptation Action Plan

The BEI is an official part of the SECAP and a prerequisite to SECAP elaboration, as it will provide knowledge of the sector of the entities emitting CO_2 on the municipality's territory, and will thus help

select the appropriate actions. Inventories conducted in later years will allow determining if the actions provide sufficient CO_2 reductions and if further actions are necessary.

European Energy Award

An important example of both benchmarking and standardisation is the European Energy Award (eea). As a quality management system and certification process, the eea establishes interdisciplinary planning and action as well as a process-oriented and long-term energy and climate protection policy in the municipalities, in six different areas: mobility, supply and disposal (electricity, district heating, renewable energy sources, water supply, sewage, waste, etc.), communal buildings & facilities, urban planning & development model, internal organisation (including continuing training, performance agreements, and planning & controlling) and external communication & cooperation information.

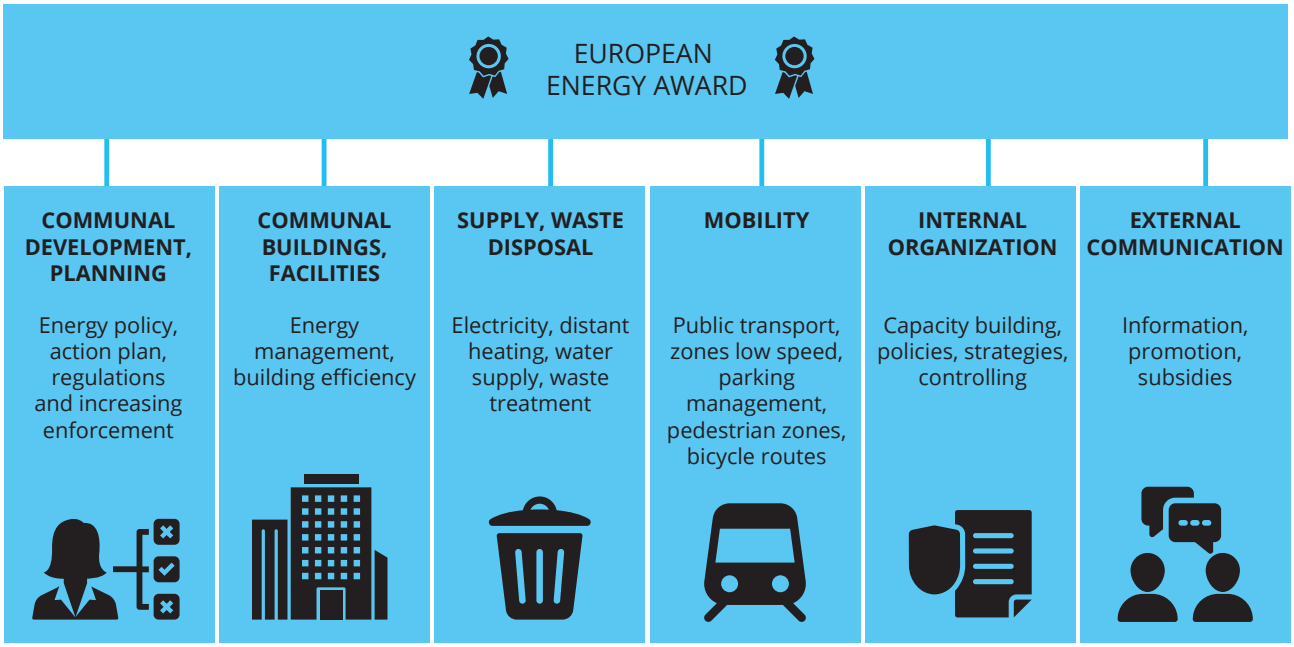


Figure 0-3 The main activities of the municipality in the field of energy and climate protection in the eea. Source: eea, International Office.

Citizens are key partners and players in the eea governance model. More than 1500 cities and communities in Europe have already implemented eea. The basic principle of the eea is the process based on the management cycle of "analysing – planning – implementing – auditing – adjusting" that is typical in the business world, supplemented by the "award".

eea is fully consistent with major global quality management systems standards, in particular ISO 50001 (Energy Management Systems) and ISO 37101 (Sustainable Communities Management system). Several municipalities have successfully implemented both schemes (ISO quality management systems and eea) simultaneously.

CEN/CENELEC/ETSI SF-SSCC

CEN/CENELEC /ETSI SF-SSCC is a joint group of the three European Standardisation Organisations (ESOs) that acts as an advisory and coordinating body for European standardization activities related to Smart Sustainable Cities and Communities field. It does not itself develop standardization deliverables (EN, TR, TS). The Sector Forum:

- Liaises with relevant international initiatives (such as those within ISO, IEC and ITU) and prepare an overview of suitable standards already publicly available (from the International Standards Organizations ISO, IEC and ITU) to meet specific needs for smart and sustainable cities and communities;
- Analyses and recommends standards for development, implementation, adaptation, or revision by CEN, CENELEC and ETSI;
- Organises an annual event on standardization activities for smart and sustainable cities open to relevant stakeholders to collect needs, share experiences and favour exchange to support convergence on common SSCC issues;
- Liaises and coordinates with relevant European initiatives (such as for example the European Innovation Partnership (EIP) on Smart Cities);
- Identifies and gives due consideration to European innovation/research projects which might impact the field/subject;
- Considers and advises stakeholders on any strategic issues and developments concerning standardization for smart and sustainable cities and communities;
- Informs on latest legislative developments occurring at the EC level (if any) and on the status of standardization work undertaken by relevant European Technical Committee/Technical Bodies.

Key issues in integrated planning and management of smart city projects at district level

Transformation of the built environment by realising low or positive energy districts, clean mobility and logistics, and integrated physical and ICT infrastructures with a high level of interoperability, is usually quite difficult and time-consuming to bring about.

A novel, integrated approach to planning and implementation, which considers not only the full life-cycle of planned investments in the built environment, but also the entire community influenced by them, addresses and facilitates these issues. This prevents smart city projects failing during preparation or at the start and increases their success rate during implementation. This approach is based on information on best practices and commonly experienced pitfalls shared by successful projects. Its features can be summarized as follows:

KEY ISSUES IN PLANNING AND IMPLEMENTATION OF SMART CITY AND LOW ENERGY DISTRICT PROJECTS	... AND FEATURES OF AN INTEGRATED APPROACH ADDRESSING THESE KEY ISSUES
More often than not, the **timeframe of policies and decisions is limited to the current political cycle**, what makes it difficult to fulfil long-term obligations and ambitions the city has committed itself to, regarding adaptation and mitigation of climate change, enhancing energy affordability and security, improving environmental quality. For example, SDGs, COP21, national and EU policies need a long-term vision to plan things within a certain timeframe.	A genuine **long-term perspective** beyond the current political cycle, agreed upon with the stakeholders, is key to ensure that short term actions during the political cycle contribute to long-term aims, and helps cities to fulfil their obligations. 80% GHG reduction in 2050 is a result of energy and mobility decisions taken now. What is more, the long-term perspective makes the long-term aims resilient and robust through endorsement of the local community.
Generally speaking, the **focus is on specific issues and technologies,** without taking much of a holistic, interdisciplinary approach. As a result, potential synergies remain usually unrevealed when projects are prepared, while they might significantly contribute to meet the targets. Synergies need to be identified and seized long in advance and can save money by a smarter use and operation of the built environment, often with the help of ICT and sensors, but also by better planning. For this reason, a holistic approach is closely linked to a long-term perspective.	The **holistic, interdisciplinary and multi-sectorial approach identifies and stimulates to exploit potential synergies**, such as the deployment of bi-directional exchange of energy between buildings and electric vehicles in districts. The advantage of contemplating different options and their pros and cons from the viewpoint of potential synergies, has been amply demonstrated in the eea cross-sector approach, where an external advisor educates staff in inter-disciplinary thinking. What is more, it ensures that added value is created for citizens by high-quality smart sustainable development.
The involvement of many government and business sectors while lacking experience in interdisciplinary collaboration or having unclear mandates, can lead to the so-called **“siloes”, hampering smooth collaboration.**	**Internal and external vehicles for collaboration** in smart city projects, such as interdepartmental taskforces, special staff units, or legal entities as associations and public- private partnerships (PPP’s) are needed to overcome siloes within government sectors and businesses and to enable public-private collaboration.
Key stakeholders as citizens and local businesses, but also energy network and transport operators, **might be difficult to engage or having other priorities**. Besides, many interdependencies exist among these stakeholders during the planning and implementation phases of smart city projects. Each stakeholder possesses a piece of the jigsaw puzzle but must be willing to put it in place. Deregulation and privatization of local government entities in the past might have led to other priorities, such as operational reliability and profitability, over energy efficiency and sustainability.	**Wide, early and in-depth stakeholder engagement** is needed to achieve agreement on the final aim of the project and the proposed measures, **and to tie in other benefits** important to the users and owners of the buildings and infrastructures, such as more comfort, a new kitchen, less air pollution or more playgrounds. Co-design, co-creation and co-production is therefore quintessential features of integrated planning and implementation.

Business cases and **business models might be less attractive** than regular investment opportunities. While the financial burden of refurbishment and upgrading of urban infrastructures and buildings can be too heavy for individual owners and operators, proposed investments in projects are often too small for finance industry, leading to higher transaction costs and thus less profitability. Besides, innovative solutions are often perceived as riskier, while financial industry might lack the technical skills for proper assessment of perceived risks. As a result, an **aversion to these risks** makes it difficult to finance smart city projects	An early exploration of new business opportunities, of possible changes in value chains not only in the private but also in the public sector, of preconditions of different sources of financing and of instruments to "de-risk" investments, can help to develop better business cases and find investors, while developing the contours of the smart city plan. **By creating more trust, plans are de-risked** and become more attractive for financial investors. A systematic scan of areas where particular smart city solutions could be applied within the local governments' jurisdiction, can help to bundle demand and define better business cases or set-up instruments such as revolving funds.
In a common municipal culture of outsourcing and subcontracting, the **final performance of subcontracts and their contribution to cities' overall aims, is usually not assessed** and thus often unknown. Subcontracting and tendering is done without a long-term vision in mind.	Monitoring and evaluation of progress according to Quality Management Systems approach, ensures that **the cities' overall end goals are eventually met**. The SCGP lists a few major sets of KPI's, to help cities and communities to track and evaluate the progress of their smart and sustainable projects and programmes, both for sectorial management and reporting or communication purposes.

Table 0-2: Key issues in planning and implementation of smart cities and low energy district projects

The Smart City Guidance Package

What is the Smart City Guidance Package?

The SCGP explains how to develop and apply an integrated approach in planning and implementation of smart city projects. It explains the different stages in developing a coherent roadmap and the to do's at each stage. Besides, it gives examples and discusses key success factors and common pitfalls for the introduction of smart city solutions. What is more, the guide explores various accelerating actions that that can help to achieve more impact locally through replication and scaling up in cities.

It is intended as a self-help guide that wants to inform and inspire by sharing experiences and best practices of other cities, thus paving the way for smooth implementation of smart city projects. The SCGP does not discuss technological solutions, but the preconditions and processes that need to be organised for a successful planning and implementation, deploying a holistic perspective.

How has it been developed?

To better facilitate sharing of knowledge and experiences between the cities participating in the EIP-SCC Action Cluster IPPR, it was decided to bundle best practices in the form of a "cookbook". With the aim of gathering information for this "cookbook", the EIP-SCC Action Cluster IPPR organised several workshops in 2016 and 2017 involving commitments and other public authorities. Topics explored during these workshops were phases of implementation, key stakeholders and their roles, common pitfalls and

barriers during planning and implementation, innovative solutions and best practices, the role of standards, and how to ensure replication and upscaling. Based on the outcomes of these workshops, preliminary content for the SCGP was further developed through interviews of city representatives, projects managers and researchers and desk research of FP7 and H2020 smart city projects, in particular of SCC01 lighthouse projects.

Besides, through ERANET and JPI Urban Europe, 17 additional medium-sized Smart Cities were engaged, and have provided the findings on REPLICATE & SCALE UP. The AC IPPR initiative "KPI's and tools for decision making and benchmarking", led by Bernard Gindroz (European Energy Award-eea-, CEN/CENELEC), has bundled experiences and best practices in the field of roadmap development, monitoring and standardization, in particular on the methods used by eea. The findings were discussed with lighthouse and fellow cities, ICLEI and Eurocities city networks, and SCC-01 project managers, and enriched with their feedback. Eventually, all these inputs were combined in this novel methodology for developing a coherent roadmap for integrated planning and implementation of smart city projects that is at the heart of this guidebook.

A roadmap for integrated planning and implementation

Long lasting impact on the city

Decisions on investments in new transport, ICT and energy infrastructures, on real estate development and on the refurbishment of existing buildings, and on urban planning and city development, are taken today but will have an impact on the city for decades. What is more, most plans for smart, low carbon cities require approval of users and owners for specific measures, and for sharing of the financial burden. Lastly, most smart city projects have a lengthy preparation time, especially when they plan to make changes to physical infrastructures and buildings.

For these reasons, it is essential to have a vision shared and agreed with major stakeholders, investors and especially citizens and local businesses. The key question is: "how do we want to see the city we are living in, in 20, 30, or 50 years from now"? The SCGP roadmap ensures a coherent elaboration of this central vision during seven consecutive stages, each refining and concretising the outcomes of the previous stage. The methodology anchors the long-term perspective, emphasizes cross-domain collaboration, and takes into account the different roles and interests of stakeholders in the local ecosystem. In this way, coherency and a holistic perspective are ensured throughout the process.

Steps from planning to implementation

The path from planning to implementation can be summarized as follows:

- If an overall long-term city vision is not in place, this stage **creates a vision** that is shared with and supported by other internal and external stakeholders. Otherwise, an overall long- term city vision or specific plans such as SE(C)AP, might need to be attuned to smart city developments. It describes the long-term objectives for the smart city plan(s);
- From such a consensual vision, capturing long-term expectations for the city, a **political commitment/decision** of the city and the stakeholders is needed to start preparations, which work out the vision in a strategy and proposed actions. This commitment/decision also ensures a coherent alignment of priorities, through a holistic approach;
- By prioritising actions, operationalising them and defining them more narrowly, by setting precise targets and milestones, allocating responsibilities, and selecting a portfolio of projects, one or more **plan(s) are drafted**. This stage also establishes an urban platform for information and knowledge exchange, both internally and externally;

- Actual **implementation of plans** and projects takes place in the Do stage. With a culture of achieving results, this usually involves many amendments and changes, and a feedback loop with the subsequent stages Check and Act is established at this stage, in line with the Quality Management Systems approach. This enables an iterative cycle of improvement to achieve the set targets and agreed strategic objectives, in order to meet the vision collectively set up and agreed upon earlier. This stage uses the feedback from:
  - **Measurement** of progress and evaluation against the targets as represented by the KPI's during the Check stage. This_continuous assessment of progress of the project, gives clues for improvement if needed;
  - **Improvement** by making actual changes during project implementation to ensure that the targets are met in the Act stage;
- Throughout the process, particular attention to **keeping the engagement** of all stakeholders and citizens must be ensured, through communication and wide engagement;
- The stage of **REPLICATE & SCALE UP** organises the preconditions and support for repeating the project(s) at other locations, both within and outside the city's territory and jurisdiction, and for bundling of demand in the market. Sharing of experiences and best practices is key to further market uptake and acceleration of smart city solutions, as success stories build trust and help to move from consultation to agreement.

This generic flow of stages, based on the well-known policy cycle, is common to all quality management led projects. However, in the case of cities and communities, the wide range of stakeholders with different interests makes it much more complex. Special skills in the field of cross-domain, multi-sectorial, systemic and holistic thinking are needed to consult and consider all interested parties, especially citizens, prior and during the implementation of any major strategic plan or project.

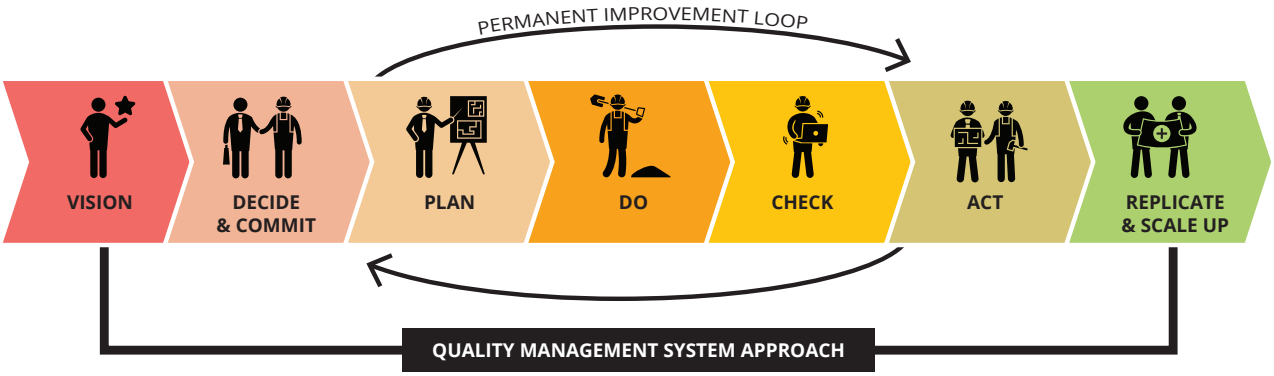


Figure 0-4 Steps from vision to implementation and permanent improvement loop

The scope of this roadmap ranges from sectorial, but with a highly holistic perspective, to highly integrated smart city plans. The different stages are based upon the Plan-Do-Check-Act concept, which is extended with a couple of stages which are deemed relevant for smart city and low energy district plans. The order and description of the content of each stage are based on common experiences of cities participating in the European Energy Award, lessons learned in the CONCERTO programme, and material from interviews with managers of FP9 and Horizon 2020 smart city projects. Finally, the stages take into account that the UN Sustainable Development Goals have been adopted by the EC and are therefore relevant to European smart city roadmaps as well (see figure 0-4).

With the term "cities", city council and city administration are meant. The term key stakeholders refers to those stakeholders crucial for integrated planning and implementation of the smart city roadmap, such as citizens, and transport and energy operators.

From vision to results

The methodology proposed here in the SCGP, is partially based on the Quality Management Systems approach. This approach wants to guide local authorities in their efforts to stimulate and co-ordinate sustainable development. It is designed to take stock of existing activities and plan future initiatives in a holistic manner, to form and communicate a coherent, sustainable development strategy that supports the main objectives and final aim of each city's vision. In this way, a holistic "helicopter" view is ensured as an alternative to managing sector by sector with unconnected sectorial plans.

Its main elements are:

- Political mandate for implementing sustainable development;
- Identifying and engaging stakeholders, developing consensus on priorities;
- Evaluating, benchmarking and measuring current and future conditions that impact progress toward sustainable development;
- Developing and implementing a coherent action plan;
- Forecasting and back casting methods for bridging visions, targets and actions;
- Setting targets and KPI's for sustainable development;
- Meeting city's needs to carry out all these functions;
- Monitoring, reporting and verification. clarify responsibilities;
- Ensuring that there is consensus on who holds the coordinating role that has the needed competency and can be a vision holder to safeguard that the project fulfils the decided KPI goals and that criteria are met.

Stages in reality less distinct

From the interviews and workshops conducted with key players such as smart city project managers and project partners, it appears that the different stages of implementation usually follow a more complex path than sketched above. The intensive, multi-sectorial collaboration that is required in integrated smart city projects between city and stakeholders with different backgrounds and roles, and the technical and organisational complexity of most projects, makes that often substantial amendments have to be made to the original plan during its implementation. In addition, many smart city projects are characterised by a high level of experimentation and some trial-and-error (living labs, testbeds, experimentation zones), what may result in a couple of rounds before satisfying outcomes are achieved. In reality, project progress often follows a more cyclical path, where project stages cannot be clearly distinguished, but are continuous processes occurring simultaneously (see Borsboom-van Beurden et al., 2017). Nevertheless, for the sake of clarity, this document assumes a linear sequence of stages when describing the distinct steps from planning to implementation in more detail.

Users and processes supported by the SCGP

Potential application of the SCGP

Different user groups can be identified, each with their own needs. Foremost, this guide targets politicians and administrations of cities that are planning to implement smart city projects and low energy districts in the foreseeable future, such as **fellow cities of lighthouse projects** and **cities participating in the Covenant of Mayors for Climate and Energy initiative**, what leads to a pipeline of projects. In addition, the SCGP is meant for key stakeholders of cities in these projects such as energy network and transport operators, citizens and local businesses, and solutions providers.

The SCGP supports the following processes within local governments:

- Preparation of smart city strategies;
- Framing of smart city strategies within the wider context of long-term city visions and departmental plans;
- Better decision making and better subcontracting and procurement having a long-term vision in mind;
- Translation of strategies into concrete smart city plans and actions;
- Orientation on possibilities for plans in future;
- Use of KPI's for monitoring of progress and adjustment of plans.

Other, less tangible benefits come for the SCGP changing the mind-sets of the cities' key stakeholders, enablers and advisors by:

- Aligning the perceptions of city administration and key stakeholders, such as citizens, mobility and energy operators;
- Providing the basis for technical assistance in URBACT or preparing plans for the EIB;
- Supporting the project manager responsible for integrated projects, whose main competences are often administrative or in management, but who is sometimes lacking technical background;
- Improving the overall knowledge level on smart cities and low energy districts within the city administration and the local ecosystem;
- Reaching a common awareness and understanding needed for successful planning and implementation, not only within cities but also with external partners making smart city projects more attractive for financial investors.

Beside cities and their key stakeholders, enablers and advisors, a wide range of other user groups have been identified, such as EU Urban Agenda partnerships and cities orienting themselves on applying smart city processes in future. The SCGP can have added value for the exchange of information and best practices for integrated planning and management of smart city projects through networking and dissemination at European scale. The availability of a document sketching how to do this in a proper way, can thus stimulate the wider market uptake within Europe by:

- Knowledge sharing;
- Replication and scaling up of smart city projects in other cities;
- Bundling of demand with better chances of ensuring project finance.

Beneficiaries

The table below highlights different uses of this SCGP, for cities having different levels of experience in the integrated planning and management of smart city projects, for various urban stakeholders and for different purposes.

TYPE OF STAKEHOLDER	WHO SPECIFICALLY	USE OF SCGP
European cities and their partners – preparing the next generation of implemented smart city projects		
Follower cities, who have already built the competences and need to secure financing. They are the ideal partners to kick-off a pipeline of projects	Political level local government	
	Politicians and administration, local government: mayor, alderman, city council	Provide general information about process of smart city strategy preparation and implementation of plans, get everybody at a level playing field. How to track progress and measuring impact. Help anchoring political commitment. Give ideas about how to organise the last mile to the bank. Show general approach to frame short term actions in long-term goals (temporal coordination)
	Supporting staff as strategists and advisors	Show how to develop strategies and plans in an integrated, well-coordinated way, fitting in cities' overall aims. Provide information on financial instruments and stakeholder engagement. Ideas for urban transition management
	Operational level local government:	
	Directors of unit	Pave the road for realising specific project pipelines
	Technical staff	Raise awareness of context for planning and implementing technical measures
	Practitioners	References to specific methods and solutions, as well as obstacles and barriers
	Project managers of smart city and low energy district strategies plans and projects	Educate project managers, who usually have a background in traditional project management which does not equip them fully for smart city projects. Get everybody at a level playing field: different backgrounds of project managers and staff in the following cities, who come from different sectors as lighting, facility management, construction, real estate. SCGP can facilitate transfer of knowledge to follower cities by showing how to do integrated planning and implementation, and find a way to overcome often occurring difficulties. Information about problems and failures is as important as on best practices. Provide also basic information on other solutions than those tested in the lighthouse projects. Help developing the project further by showing the different phases and components.
	Other local authorities e.g. water boards	Get everybody at a level playing field in terms of understanding

Private or public partners involved as key players in preparation and implementation of a smart city plan, partners of cities interested in developing future smart city plans	Owners and operators of transport and energy network operators, energy and transport providers, utilities network operators	Inform and involve public administration managers, such as energy providers, transport, etc. who are often responsible above the city scale, at regional level, for instance an energy grid manager, or partners providing energy
	Owners of infrastructures, buildings and land	Get everybody at a level playing field in terms of understanding. Provide information about methods for co-design and co-creation, and financial instruments
	Housing associations, real estate developers	Inform about the planning and implementation of technical solutions, engagement of end users as tenants or buyers and financial instruments.
Providers of technical solutions	Building and construction industry, ICT	Inform about possible coordination issues during integrated planning and implementation around technical solutions, and inform about the engagement of stakeholders and end users
Consultancy and engineering	Advisors, architects, consultants, engineering	Provide general information about process of smart city strategy preparation and implementation of plans. Inform about technical and spatial coordination issues during integrated planning and implementation of technical solutions
Research and innovation partners	Research and Technology organisations, Universities	Provide general information about process of smart city strategy preparation and implementation of plans, as contextual information for methods and technologies.
(End)-users and owners of buildings and services	NGOs Local businesses Citizens, tenants Interested citizens and local businesses Bottom-up initiatives	Find examples for stakeholder involvement through co-design and co-creation. They are the end-users ultimately, possibly also co-creators. How to develop a common operational picture with tenants and owners of buildings?
Further existing, expanding projects, like FP7, EU Urban Agenda projects		
Reference cities in lighthouse projects, EU Urban Agenda partnerships. Also for the thematic working groups working on the Urban Agenda	Cities, in particular innovation manager, solutions providers, knowledge partners, citizens	Show how to develop strategies and plans in an integrated, well-coordinated way, fitting in cities' overall aims. Provide information on financial instruments and stakeholder engagement. Ideas for urban transition management.

Internal EIP-SCC initiatives as Positive Energy Blocks, require some matchmaking	Cities participating in EIP-SCC	Provide information on financial instruments and stakeholder engagement
Investors might be interested. Investors look for a project pipeline.	Both public and private, so fund managers and subsidy managers	Cities do not have the pipeline of projects. SCGP could present projects at a timeline with given return on investment
Cities orienting themselves on applying smart city processes in the wider Smart City community		
Any SC inspired project, regardless of how integrated its approach	Cities participating in the European Energy Award, Cities committed under the Covenant of Mayors for Climate and Energy, Member of city networks as Eurocities, ICLEI,	The audience is coming from different origins but need some content. Pass the message to everybody in the same boat, beyond the Horizon2020 SCC-01 Lighthouse projects.
	Managing authority of structural funds	Provide ideas about how structural funds can contribute to urban transition, by fostering planning and implementation of smart city projects
Operational perspective because of different kinds of national-local structures in European countries		
Regional authorities	Regional government: region council, regional committee, counties	Can influence municipalities and provide additional funds.
National authorities	Ministries	SCGP can inform civil servants about the planning and implementation of smart city projects and help to enable the national government to support local projects in various ways (funding, legislation, knowledge exchange, collaboration within Europe)
Other audiences		
Other H2020 projects with demonstrator-follower city principle as Nature based solutions	City representatives, solution providers, knowledge partners, citizens	Methods for ensuring the transfer of knowledge and information

Table 0-3: Use of SCGP per type of stakeholders

Organisation of this guide

This guidebook is organised according to the different stages in the roadmap for integrated planning and implementation of smart city projects as explained earlier.

Each chapter corresponds to a particular stage and gives a checklist of to do's for that stage, examples of best practices and of common barriers and pitfalls. Chapter 1 describes the development or adjustment of a long-term vision and objectives, and a first exploration of possibilities for collaboration within the local ecosystem. Subsequently, Chapter 2 explains how the long-term vision is concreted in a politically decided strategy, and how the city and its allies commit their resources to start preparing a plan. The operationalisation of the strategy in concrete actions, targets and milestones, is demonstrated in Chapter 3, while Chapter 4 discusses the actual implementation of the plan(s). Chapter 5 deals with how the outcomes of monitoring of progress can be used to propose changes in the implemented measures or in the original targets. Following, the realisation of proposed changes is highlighted. Chapter 6 and lastly, Chapter 7 explains which accelerating measures can be taken to facilitate replication and upscaling of successfully demonstrated smart city and low energy district solutions. Finally, the main conclusions are drawn, and next steps discussed.

1 STAGE 1: HOW TO START? CREATING OR ATTUNING A JOINT LONG-TERM VISION

1.1 Background

The vital importance of the long-term perspective

A **long-term perspe**ctive on the city beyond the current political cycle, taking into account the full life-cycle of planned investments in the built environment, and agreed upon with stakeholders, is key to ensure that short-term actions in the field of smart cities and low energy districts, have a larger impact, and help to achieve the cities' long-term aims and to **fulfil their local, national and European obligations**, such as SEAPs and SUMPs. Decisions taken today have a long-lasting impact on the city while most smart city and low energy district plans need a considerable time for preparation. The buy-in of the local community makes such a long-term perspective even more robust and resilient, as stakeholders have to approve, co-design and frequently co-finance the planned measures. Despite its vital importance, this part is not always adequately covered:

- Some city administrations do have an overall city vision on the quality of life they want to offer their citizens in the future, encompassing objectives on themes as adaptation to and mitigation of climate change, energy security and affordability, housing, mobility, sustainability and environmental quality, inclusiveness, digital access and economic competitiveness. Such a vision can serve very well as the starting point of this roadmap, but might need some adjustments or specific focus.
- Other cities lack a long-term perspective on the objectives of smart city and low energy district plans. The strategy behind these plans is then insufficiently connected to the long-term objectives, what can lead to suboptimal choices and can make implementation vulnerable to political changes and lack of support of stakeholders.
- In other cases, cities do have a sound, commonly accepted long-term perspective, but it is not concrete enough or not yet linked to a smart city or low energy districts strategy, leading to a lack of political commitment for proposed plans, which subsequently have a difficult start or might fail later on.
- It might also happen that a smart city strategy is considered as an external blueprint, not reflecting local priorities and circumstances. As a result, there is no ownership of the plans and the suboptimal choices might be made given local specificities.
- Sometimes many smart cities and low energy district plans are prepared separately in parallel, for instance SEAP or SECAP, SUMP, sustainability plans, and spatial plans, investments in renewable energy sources. As a result, plans may compete for resources while important synergies between them are not realized.

The common problem in all these cases is that smart city and low energy district plans are insufficiently anchored in a jointly agreed long-term perspective, or vision, of the city. This makes the plans vulnerable during implementation, reduces support of the local community and might lead to less optimal choices.

This chapter discusses how a vision can be developed or attuned to how the city should look like in 20, 30 or 50 years from now on, in collaboration with the local community, and resulting in a clear, commonly agreed priority in long-term objectives for smart sustainable development. Here it is explained how smart city strategies and plans can develop, and the wide range of entry points for the development of new smart city and low energy district plans.

Different starting points for development of Smart City plans

Smart city visions and projects are not developed in a vacuum and have often a background in other plans with comparable aims. Here, we explore a number of common plans, which can trigger the planning of a dedicated, smart city or low energy district project, but also can amplify the impact of such a project. Of course, these separate plans can also be integrated in a comprehensive integrated urban plan, see for example the case of Nottingham (Stacey et al., 2016c).

OVERALL SMART CITY STRATEGY: some cities have recently developed explicit strategies on how to become a smart city, with the aim of realising energy efficient neighbourhoods, clean mobility and integration of current infrastructures - working with local administrations, businesses, knowledge institutes and citizens while capitalising on the potential of urban data and ICT.

SUSTAINABILITY OR ENVIRONMENTAL PLAN: environmental departments of local governments develop plans to improve urban sustainability and environmental quality. Topics dealt with are usually air and soil pollution, health, protection of natural areas, water and waste management. The focus in these plans has shifted from an approach focussed on immediate environmental quality towards the more holistic and long-term consideration of sustainability: not only now and here, but also elsewhere and later. Energy efficiency, climate change and scarcity of resources have become integrated parts of most sustainability and environmental plans and are therefore closely related to smart city plans.

Figure 1-1 Cycle of creation of and follow-up on SEAPs (SEAPs) and Sustainable Energy and Climate Action Plans (SECAPs) Source: Covenant of Mayors for Climate and Energy

SUSTAINABLE ENERGY ACTION PLAN (SEAP) AND SUSTAINABLE ENERGY AND CLIMATE ACTION PLAN (SECAP): The Covenant of Mayors for Climate and Energy is a European initiative by which towns and cities voluntarily commit to mitigate and adapt to climate change. Until 2015, signatory municipalities had to draft a Sustainable Energy Action Plan (SEAP) where they committed to reduce their

CO_2 emissions by at least 20% by 2020. Since 2015, municipalities have pledged to reduce emission by at least 40% by 2030 while adapting to climate change and improving access to sustainable energy. Those commitments are outlined in a Sustainable Energy and Climate Action Plan (SECAP). These formal commitments can be an important pillar of any other smart city or low energy district plan. The plans follow an integrated, cross-domain approach, and address the whole territory of the municipality. Plans should include at least the sectors of buildings (municipal buildings, tertiary buildings, and public lighting) and transport.

ENERGY VISION, ENERGY PLAN: many cities have developed local energy plans with the aim of reducing fossil fuel consumption by households and businesses, preventing energy poverty, increasing the share of renewable energy, improving energy security and organising energy supply in a smart, sustainable yet secure way, for example by upgrading urban heat networks and creating smart grids. SEAPs, SECAPs, European Energy Award (eea) and other sustainable energy plans are closely linked to smart city plans and can form the backbone of such plans.

TRANSPORT AND MOBILITY PLANS: securing accessibility, connectivity and safety, while reducing congestion, air pollution and GHG emissions, are often the main goals of transport and mobility plans. New technologies such as Intelligent Transport Systems and urban data from smart phones and sensors, offer new possibilities to address these challenges in a smart way, thus contributing to clean, sustainable mobility. An important source of inspiration is the CIVITAS initiative (CIVITAS, 2019), which tested over 800 measures to make urban transport in hundreds of European cities cleaner, better, and more sustainable. Some CIVITAS projects have been followed up by more integrated smart city plans with a wider scope, also encompassing low energy districts and integration of infrastructures.

SUSTAINABLE URBAN MOBILITY PLANS: as part of the EU Commission's Urban Mobility Package, the Sustainable Urban Mobility Plans (SUMPs) have been launched in 2013 (European Commission, 2013), in order to provide local authorities with integrated planning guidelines to stimulate more sustainable modes of transport by developing long- and short-term mobility strategies. Next to sustainability, these strategies should also address economic viability, social equity and environmental quality. Through a transparent and participatory approach, citizens and interdepartmental stakeholders should define budgets, timetables, targets and objectives, and select indicators for improving and periodically assessing urban mobility performances.

URBAN RESTRUCTURING, REHABILITATION, REAL ESTATE PROJECT DEVELOPMENT: the intention to redevelop or rehabilitate parts of the city such as former harbour areas and industrial premises or dilapidated housing, can be a reason to do so in a smart way and make the area an example of a smart, low energy district. Often, such restructuring offers excellent opportunities to make drastic changes to urban energy and mobility infrastructures, to construct energy efficient buildings, to improve energy performance of buildings in need of upgrading, to build advanced digital networks and to improve quality of public space. Investment plans of private equity, pension funds, and insurance companies, can stimulate energy-efficient real estate development and maintenance in such areas.

MASTER PLAN AND ZONING PLANS FOR AREAS: the development and updates of spatial plans for areas in case of urban transformation, densification and expansion, can be a trigger to improve the carbon footprint of these areas. For example, by including collective energy solutions, such as a collective photovoltaic (PV) array or district heating, or by use of specific building codes. Although it is mandatory to assess the possible environmental consequences of land use and transport changes in master and zoning plans beforehand, for example on air quality, consequences for energy efficiency, adaptation to climate change, and circular economy, are often not yet an integral and mandatory part of spatial plans, what leads to higher costs to improve urban sustainability at a later stage.

REFURBISHMENT AND RENOVATION OR MAINTENANCE PLANS FOR BUILDINGS AND URBAN INFRASTRUCTURES AS ELECTRICITY NETWORKS: buildings are commonly undergoing deep renovation every 25-30 years. This provides an excellent opportunity to improve the building envelope, its appliances and installations. When this is organised at district scale, for example, because there is a cluster of similar buildings of the same owner and type in an area, it can be an excellent entry point

for development of a smart city plan. The CONCERTO initiative (EC, 2014) has demonstrated that energy-optimisation of entire districts is more cost-effective than optimising buildings individually: existing buildings can cut their CO_2 emissions up to 50%, at acceptable costs, by implementing renewable energy sources, innovative technologies, and an integrated approach. Similarly, maintenance cycles for energy, transport and utilities infrastructures, can be used to make them smarter and more sustainable. For example, the need for renovation of natural gas networks, can be an excellent opportunity to phase out this fossil fuel and make districts all-electric combined with clean production of electricity (see for example Hoogervorst et al., 2019).

HORIZON2020 AND NATIONAL OR REGIONAL RESEARCH AND INNOVATION-BASED PROJECTS: many smart city plans are initiated as follow-up of regional, national or EU-funded FP7 and Horizon2020 research and innovation projects. FP7 projects such as CELSIUS, STEEP, SINFONIA and TRANSFORM have enabled cities to lay the foundation for more complex, highly integrated smart city strategies and projects. Cities could analyse the local potential for clean mobility and low energy districts by developing scenarios and exploring what-if questions, simulating expected energy savings and CO_2 reduction. Many FP7 projects have served to study the feasibility of various solutions, before implementing the most promising ones in new smart city projects. For example, the cities developing holistic energy designs in STEEP have implemented these plans later in Horizon2020 SCC-01 project REPLICATE. Other research and innovation projects can also boost collaboration of local government with industry, citizens, local businesses, and research institutes, thus building a local ecosystem. The Horizon2020 SCC-01 lighthouse projects have implemented ambitious, highly integrated smart city plans since 2014, and the demonstrated solutions can be replicated now in other places.

BOTTOM-UP INITIATIVES: individual citizens, local businesses and NGOs concerned about sustainability and climate change may have organized themselves and propose plans for making neighbourhoods more energy efficient or increasing the share of renewable energy, for example by collective photovoltaic systems or exchange of energy between different energy consumers. Citizens and businesses might also initiate plans for clean mobility and logistics, such as electric car sharing, or distribution boxes.

EUROPEAN ENERGY AWARD: In its implementation, eea supports cities in defining their baseline (initial review) and identifying the potential for improvement, for setting ambitious but realistic targets, and help the city to prioritize the actions. eea ensures, through external certified auditors, a regular evaluation of the improvement with a possible label when targets are met. eea is thus a management system with certification (label) principle, based on regular audits and sets of KPI's common to all cities.

ICT AND DIGITISATION PLANS: can enable new smart city projects by generating more urban data, constructing specific infrastructures as glass fibre, broadband internet and city-wide Wi-Fi, and improving accessibility, connectivity and interoperability, for example with respect to Internet-of-Things (IoT) and Internet- of-Everything (IoE). Many cities are experimenting with living labs, where smart phones, sensors and actuators, provide real time data that can be combined with more conventional data sources. In this capacity, ICT and digitisation plans and project often pave the way for smart city solutions as Intelligent Transport Systems (ITS), and smart grids.

1.2 Checklist for the VISION stage

This section discusses the first stage of the roadmap for integrated planning and implementation: the **VISION** stage.

Due to the long-lasting impact and lengthy preparation time of smart city projects, and the community involvement in co-design, co-financing and co-realisation of plans, it is of utmost importance to have a vision shared and agreed with major stakeholders, investors and especially citizens and local businesses. The **key question** addressed in this vision is: "**How do we want to see the city we are living in, in 20, 30, or 50 years from now?**" Before making any decision, there is an absolute need to agree on such a vision and to make it robust by guarantees that this vision will not be changed at each new political mandate or cycle. The vision should be the consensual result of an extensive consultation of all concerned stakeholders, in particular of the citizens who live in the city. This engagement of all stakeholders is key to successful integrated planning and implementation of smart city projects.

This stage creates this **VISION**, which is shared with and supported by other internal and external stakeholders, and describes the long-term objectives for the smart city plan(s). It can also be that an up-to-date overall long-term city plan or strategy already exists, but needs to be better attuned to smart city and low energy district topics. The same goes for related plans such as SE(C)APs and SUMPs, which might need to be better aligned with other municipal plans or business strategies of energy suppliers or transport operators. In these cases, the roadmap for integrated planning and implementation can build upon the existing vision, strategy and the approval of implementation. The added value of this methodology for those plans is then a wider scope, which fosters a cross-domain and multi-sectorial approach, and concrete suggestions for ensuring capacity and other resources. The same steps can be taken, but less time might be needed for the first step of problem definition as the overall long-term city vision, SEAP or another plan, is the point of departure.

The following steps are taken to achieve a **VISION** shared with and agreed upon by major stakeholders. At first, it has to be made more precise, which problem(s) or issue(s) the city actually wants to address with one or more smart city projects, and what is known about this problem or issue so far. Subsequently, it is important to take stock of what be more or less needed to solve these problems. Because the consent and help of key stakeholders are indispensable in this, in the next step the local ecosystem has to be organised in case it is not built up yet, to ensure smooth collaboration with these particular problems and have the right people around the table. Often one of the problems in cities aspiring to introduce smart city or low energy district solutions is that the local ecosystem is not yet sufficiently developed.

Figure 1-3 Checklist of to do's at the VISION stage

STAGE 1: VISION

Question:

How do we see the city we are living in, in 20-30-50 years from now on?

TO DO 1: DEFINE THE PROBLEM

by making more precise which problems we want to address or which existing urban vision or plan we want to realise with smart city project(s)

TO DO 2: TAKE STOCK OF WHAT YOU ALREADY HAVE AND WHAT YOU WOULD NEED

by becoming aware of financial and organisational aspects and of stakeholders which should be engaged

TO DO 3: START ORGANISING THE LOCAL ECOSYSTEM

by identifying, engaging and informally consulting key stakeholders and clarifying their roles and responsibilities

TO DO 4: BRAINSTORM

by discussing different aspects of the problem(s) and issue(s) with key stakeholders

TO DO 5: CREATE SHARED KNOWLEDGE BASE

by exploring possible solutions for the problem(s) and issue(s) at stake together with key stakeholders

TO DO 6: EXPLORE LEGISLATION AND COMMITMENTS

by charting the preconditions and binding national and EU obligations following from these, which may influence the design of your solutions

Tools & standards

TOOLS:

- direct consultations
- SWOT-analysis
- peer review
- round tables
- focus groups
- broad public hearings
- World Café
- benchmarks
- scenario planning
- foresight studies
- mind-maps
- innovative brainstorming methods (i.e. tree of knowledge)
- Espresso Maturity analysis
- NESTA method

STANDARDS:

- ISO 18901 Diagnostic of city's readiness level/ maturity level for setting a long term vision
- ISO 37101 Quality Management Systems approach
- national standards if applicable

Output:

Priority in long-term objectives for smart sustainable development laid down in vision.

Following, different aspects of the targeted problems or issues are explored with these stakeholders, to hear their opinions and understand their interests. After that, the city investigates directions for possible solutions with the same stakeholders in order to determine their feasibility and viability. Lastly, conditions following from the current legislative framework and ongoing obligations from binding commitments have to be looked into, as these determine what can be done and what the city is allowed to do, or what the city has to do anyway (e.g. implementation SE(C)AP, SUMP). This defines the degree of freedom in carving out new activities under specific mandates or legal responsibilities.

Commonly used **tools** during the **VISION** stage are direct consultations, SWOT-analysis, peer review, round tables, focus groups, broad public hearings, World Café, benchmarks, scenario planning, foresight studies, mind-maps, innovative brainstorming methods (i.e. tree of knowledge), Espresso Maturity analysis, and NESTA method (see example Scottish Cities Alliance in section 1.4) . **Standards,** which can support the **VISION** stage consist of European or international standards such as ISO 18901 Diagnostic of city's Readiness level/maturity level for setting a long- term vision, ISO 37101 quality management systems approach, and national standards if applicable.

Following the steps described above, will result in clearly prioritised, long-term objectives for smart sustainable development laid down in a city vision or comparable document.

Specific barriers during the vision stage, mainly related to governance and administration, are often mentioned and will be discussed in more detail later in this section:

- Silos: difficult inter-departmental coordination and communication;
- Impact of political cycles and changed political priorities of a long-term vision;
- Lack of leadership, political will or commitment;
- Administrative conflicts and differences in work culture;
- Insufficient awareness or interest of key stakeholders;
- Inadequate alignment of vision and plans with legislative framework and ongoing commitments.

It will be explained how such barriers can be overcome for each to do.

1.3 How?

The first TO DO at the stage of vision development, is to make more specific **which problem(s) or issue(s) the city actually wants to address** with one or more smart city projects, how the problem or issue is understood and what is known about it so far. Usually these problems or issues are in the field of adaptation to or mitigation of climate change, energy efficiency and security, energy poverty, pollution, liveability, congestion, outdated infrastructures and provision of utilities, obsolete buildings and (re)development of areas, economic competitiveness, underperforming digital infrastructures, social cohesion, etc. These issues are closely related to the SDGs mentioned in the introduction, in particular to SDG 11, to which many cities have committed themselves.

TO DO 1: DEFINE THE PROBLEM

by making more precise which problems we want to address or which existing urban vision or plan we want to realise with smart city project(s)

Strong political leadership is crucial at this stage, not coming from one of the sectors, but usually from a Mayor or Vice-Mayor, although this might differ according to the administrative organisation of municipalities per country.

In case an overall city vision or urban strategy, SE(C)AP or SUMP is in place, it is probably not necessary to identify which problems the city wants to address from scratch. Long-term objectives related to prioritized problems, can be adopted from an **existing overall plan or vision**. Focus should be then on selecting the main challenges where programmes or projects need to be better aligned. The scale level of this step is usually the entire city, not the individual districts.

EXAMPLE: Strategy #Brno2050

Development of the city must not be based on isolated ad-hoc decisions. The city administration wants to develop Brno systematically, based on evidence, with a clear vision of its future, along with the city stakeholders (Brno City Ecosystem). The aim of the strategy #Brno2050 is to create a strategy of the city, not only of the Municipality Office, to empower and engage citizens and other stakeholders. To tackle this great challenge, where everything seems to be related to everything, the development of the strategy has been divided into three areas of interest (resource management, quality of life, good governance) and into three interconnected process steps:

- Long-term: Vision 2050.
- Mid-term: three 10 years plans (2028, 2038 and 2048) with specific priorities and topics
- Short-term: several 2-3 years Action Plans (first one till 2020), where we include individual activities and projects.

The strong points of this set of strategy documents are the following. It contains a mechanism for adaptation of the long and mid-term goals. Besides, the modularity of the approach enables Brno to scale or rearrange the process. Further, each of the 23 particular values of the strategy has its own KPI´s and Guarantors (local experts of particular topics). And finally, the mechanism of implementation of the strategy is strongly connected with the Brno City Ecosystem and Brno Data Portal activities to stabilise the whole process.

A long-term perspective on the city **beyond the current political cycle**, taking into account the full life-cycle of planned investments in the built environment, and agreed upon with stakeholders, safeguards that today's decisions on smart cities and low energy districts, have an impact beyond current political cycles, and are the most suitable ones for achieving the cities' long-term aims.

Furthermore, the **lengthy preparation time** of most smart city and low energy district plans, asks for political consistency. Political cycles and changed political priorities can hamper proper implementation of a cities' long-term vision or lead to suboptimal choices when short-term effects are preferred over measures and approaches creating real impact in the long-term.

TO DO 2: TAKE STOCK OF WHAT YOU ALREADY HAVE AND WHAT YOU WOULD NEED

by becoming aware of financial and organisational aspects and of stakeholders which should be engaged

The next TO DO is about becoming aware and **taking stock of what and who are needed** in general to solve the problems identified before in terms of finance, internal collaboration, and stakeholders. Through explorative public hearings, informal consultation, and assignments to staff or consultants, information can be collected for a rough outline of the main financial and organisation aspects of the problem(s), and to find out **who in the city is essential to have around the table** in order to solve it. A preliminary list of people and organisations to contact, such as contractors, citizens and users or organisations representing them, agencies, research, and consultants, and their coordinates, must be drawn up. The scale level of this step is usually the whole city, not just a particular district.

EXAMPLE: SWOT ANALYSIS FOR BETTER UNDERSTANDING OF SUCCESS AND FAILURE FACTORS DURING IMPLEMENTATION

Within the SINFONIA project, preceding actual planning of measures with the engaged cities, experts from EURAC analysed the experiences of over a hundred completed and ongoing European Smart City projects, with the aim to provide advice and support with the implementation of similar projects. A SWOT-analysis (SINFONIA, identified as main barriers (weaknesses and threats) lack of subsidies, difficult communication between project participants and the public, and poor expertise in designing new technologies and solutions. In contrast, the most effective drivers (strengths and opportunities) are active public participation, cooperation and trust between different stakeholders, and long-term political commitment. This means that public participation is not only the most powerful driver, but also the most utilized factor to overcome the most common barriers.

EXAMPLE: SELF-ASSESSMENT OF SMART CITY MATURITY

The ESPRESSO project developed a Smart City Strategic Growth Map tool, where maturity model and radar diagram help smart cities to reveal at which particular level of maturity they are. According to those critical measures and actions, a roadmap for the smart city development can be created and practical advice on implementation can be provided to the smart cities to implement. For the European smart cities progress evaluation, the project uses CITYkeys KPI's (ESPRESSO, 2019).

WHY? The holistic approach needed for integrated planning strategies needs consultation and collaboration with multiple categories of stakeholders. Indeed, if the time duration of a planning phase is of the order of magnitude of a year, the development phase will take many years and then the infrastructures and constructions will last for decades. Thus, it is of major importance to approach THE right choice. And, for that purpose, there is a **need to consider expertise from different sectors and different stakeholders**. Different sectors because one activity/project in a specific sector could impact others (i.e. building new roads to access center-city to meet immediate needs, but planning new mobility schemes and/or moving at midterm to no traffic in the center-city; or developing district heating network without considering future intense buildings retrofit programme to improve efficiency nor thermal solar equipment on each buildings -that will strongly impact the operational condition of the district heating equipment;

It is also recommended to consider at a very early stage the **financial needs of the different options** and potential savings that might be achieved thanks to multi-sectorial consideration (i.e. scale effects and construction of temporary infrastructures).

In the same spirit, **consulting and considering citizens' voices and propositions** will help in keeping motivation and relaying support to long-term projects, as well as prevent mistakes due to no detailed perception of the authorities and/or consulting stakeholders about specific issues and points of attention at the district level that could prevent or delay the implementation of projects or their objectives;

Finally, having the complete picture of needs, barriers and opportunities, and especially an exhaustive cross-sector consideration with interface issues, will be very helpful to align decision making and investment decision, through trust.

TO DO 3: START ORGANISING THE LOCAL ECOSYSTEM

by identifying, engaging and informally consulting key stakeholders and clarifying their roles and responsibilities

As a consequence, in the next TO DO, the local ecosystem has to be organised, in case it is not yet sufficiently built up or developed, to ensure smooth collaboration on problems identified earlier.

Various types of stakeholders

Nearly all successful smart city and low energy district projects are founded upon collaboration in the triple or quadruple helix of local administrations, research institutes, industry, and citizens, local businesses and other local actors. Due to the complexity of these projects, many different stakeholders must be engaged and diverging interests must be aligned. The overview in Figure 1-4 depicts the most common stakeholders in cross-domain smart city and low energy district projects. Three main groups can be distinguished: city administrations and their staff, strategic allies and additional initiators of plans, who are indispensable for preparing and realising the project, and parties enabling a successful planning and implementation in their capacity of advisor, financier or consultant.

The **identification of key stakeholders** implies the following actions for TO DO 3: charting internal and external stakeholders, engagement and consultation of the most relevant ones (i.e. citizen focus groups), and identification of specific roles, of critical relations and interdependencies, and of legal responsibilities within the prospective stakeholder group. At this stage, the overview of stakeholders will not yet be exhaustive.

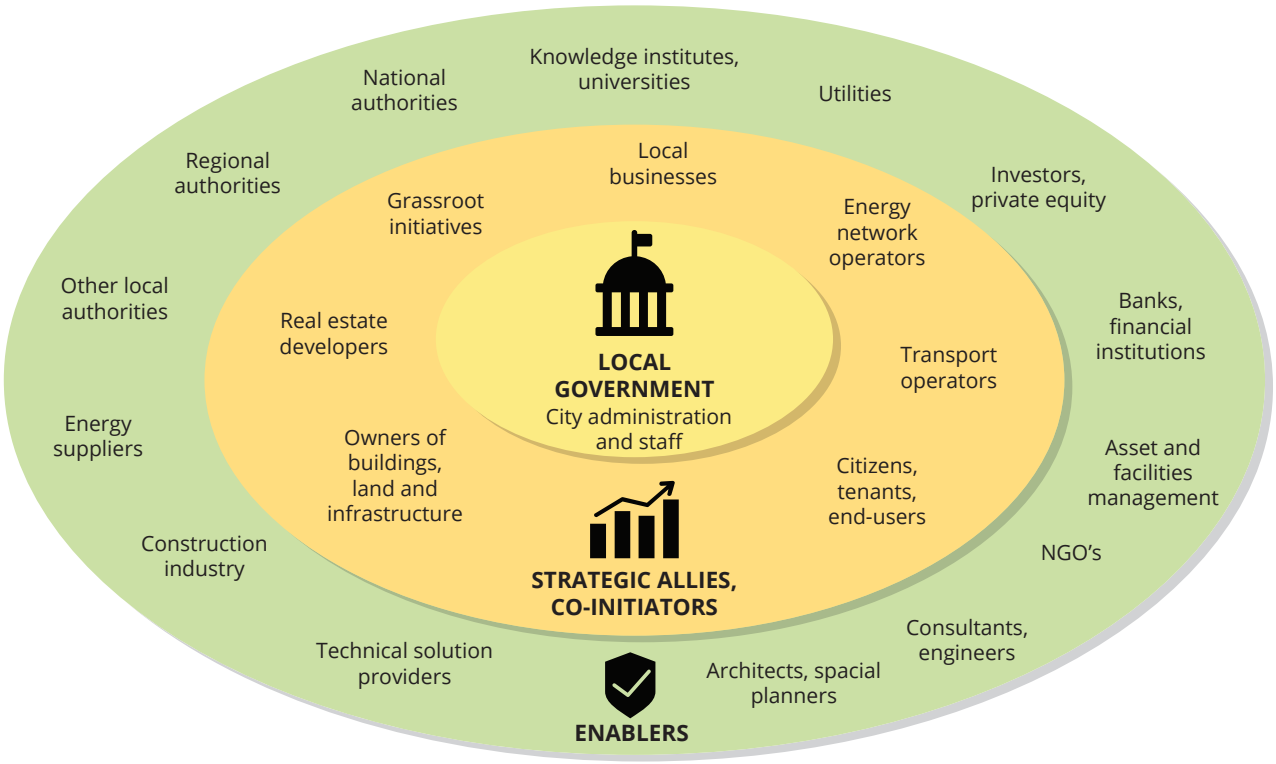


Figure 1-3 Various stakeholders in smart city ecosystems Source: Borsboom-van Beurden (2018b)

Collaboration between cities and research institutes

Potentially, research institutes can be very important partners for cities for this TO DO. They can be an important **catalyst** for new smart city projects, by using research funding for exploration of possibilities for establishing projects, testing out specific methods or technologies, or experimenting in living labs. Often the city considers its research institutes as a **trustworthy partner**, as the knowledge partners do not have to market specific solutions. Usually research has a very good overview of the methodological and technological state-of-the art in the field of smart cities. In addition, research partners can develop and test new technologies and methods, thus contributing to an **innovative local ecosystem.** They may also have expertise on social innovation around new technologies and can advise in that capacity. They can provide useful databases and quantitative models for monitoring and impact assessment of smart city solutions. Collaboration can happen in the form of smaller student or PhD projects. Universities and Research and Technology Organisations (RTO's)'s are key players in the **valorisation of knowledge.** Many cities and research institutes have managed to jointly shape an innovative environment for development and testing of new ideas, see for example Tampere, Barcelona and Amsterdam.

To realise the full potential of research as a stakeholder and partner in preparation of smart city plans, sometimes new ways of collaboration need to be established and the right preconditions created. More formal structures as a Memorandum of Understanding, exchange of personnel, physical meeting spaces, and joint experiments and living labs, all help to establish such a learning environment.

EXAMPLE: BUILDING BRNO CITY ECOSYSTEM MEK

To create a future vision, you need a present action. With this in mind, and with the overall focus of the City of Brno towards the knowledge economy sectors, it has been decided that Brno's Smart City approach will be based mainly on smart development and boosting creativity of its citizens rather than on smart technologies. Within this context, there was a need to a set up a structure to enable a vivid discussion with the many stakeholders, that are present in today´s Brno.

Firstly, the city administration set up the idea of Strategy #brno2050 as a common agenda for the stakeholders of the Brno City Ecosystem. Then the ecosystem was divided in six parts based on the well-known quadruple helix model, which was even upgraded to a hextuple model (active citizens were subdivided into individuals (BSCC) and NGO´s (BNO) and the link to the national and European levels of policy making was added (NEGL). After the initial structure was set, the city administration issued an open-call for ambassadors for each section of the ecosystem. The mandate of these ambassadors was set up for one year, a contact person on the Municipality Office was assigned to each Ambassador and the city staff started to work with the Ambassadors on regular basis (meetings, co-creation of proposals, international cooperation etc.).

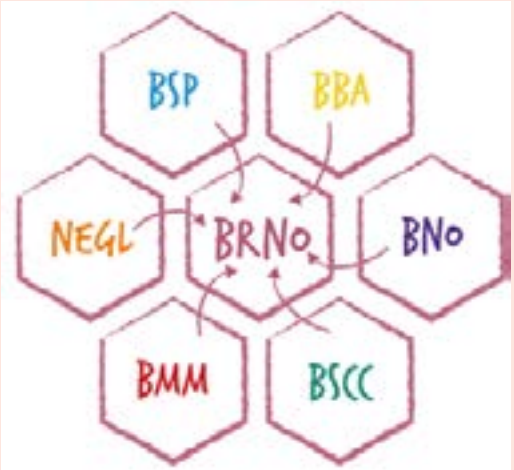


Figure 1-4 Brno City Ecosystem: hextuple helix model (BSP = Brno Science Partners, BBA = Brno Business Alliance, BNO = Brno Non-Governmental Organizations, BSCC = Brno Smart City Community – active citizens, BMM = Brno Managing Members, NEGL = National, European and Governmental Levels)

The most difficult parts were to start with the process and to set up a clear framework for the ecosystem, to describe the roles of different actors, and to develop a robust support system for it. Than the scalability is guaranteed. The city aims to have approx. 10 000 monthly active users in the ecosystem (approx. 4.5 % of the active population of Brno), who help the city staff to develop the city. At the moment a new project will start to work with local libraries to strengthen also the offline cooperation with and within the ecosystem.

WHY? As mentioned in the introduction, wide, early and in-depth stakeholder engagement is needed to **achieve agreement on the final aim of the project** and the proposed measures. TO DO 3 prepares the ground for a well-organised ecosystem in the future, enabling co-design, co-creation and co-production: essential features of integrated planning and implementation of smart city and low energy district project plans.

Regarding the **collaboration between cities and research institutes**, one has to realise that cities and research have highly different incentives and work cultures.

In **cities,** a large part of the tasks focuses on management and maintenance of cities, often by contracting and procurement. Political cycles of four or five years determine the agenda and work programme between elections, which partially depend upon regional or national policies. The political cycles are relatively short in comparison with the pace of dynamics in the built environment and its infrastructures. Within these short cycles, there is a need for quick results through policy and decision making, and thus for applicability of research and innovation outcomes. Information needs are often with respect to future developments in the city, and what that would mean for citizens and local businesses – the electorate. Democratic accountability for the spending of public sector resources and appreciation of project outcomes by voters play a very important role in assessing the success of projects.

Research, in particular universities, focuses often on exploring, understanding and explaining specific developments and relations between entities (causality). As a result, a major part of research analyses is looking at trends in the past, what might be at odds with the information that city administrations need to plan for the future. Timewise, research trajectories are sometimes not in sync with the political cycles of cities and regions. At universities, Phd and postdoc research usually take two to four years, with a substantial period spent on exploration of literature before any analysis or modelling is done. A key incentive for academics is the number of publications, especially in scientific journals with a high impact factor. Scientific language can be difficult to understand for policy and decision makers, and vice versa. Lastly, academic freedom might lead to frequent changes to research design and methodology.

TO DO 4: BRAINSTORM

by discussing different aspects of the problem(s) and issue(s) with key stakeholders

Following, different aspects of the targeted problems or issues must be explored with the stakeholders identified so far, to **hear their opinions and understand their interests**. Usually this implies organising a brainstorm on different aspects of the problem(s)/issues(s) with the stakeholders, or comparable methods for discussion and dialogue. Apart from direct consultations, many other different formats for informing and engaging stakeholders have been developed over the years, which can be used here, all with their specific pros and cons. To name but a few: world café, round tables, focus groups, public hearings, canvassing, workshops, drawing of mindmaps, citizens panels, serious games, meetings at “pop-up” temporary physical meeting spaces, or neighbourhood festivals.

In addition**, internal collaboration** within the city administration needs to be organised. Siloed municipal organisations are a problem that occurs often, discussed more in-depth in the next chapter.

EXAMPLE: PLAY AN ENERGY BOARD GAME WITH POLITICIANS, CITY STAFF AND CITIZENS

The We-Energy Game is a Serious Game that initiates a discussion about the energy transition and creates awareness among the players about the task at hand for the energy transition. Originally the game was meant to make a presentation more enjoyable, but it was so well received by the participants that it was further developed by Hanzehogeschool Groningen (We-energy, 2019). Since then, the game has been played with dozens of cities, most of them in the Netherlands.

The players can represent the following roles: People, Planet, Profit, Balance, Legislation and Production. They place small cards representing certain quantities of renewable energy sources on a map of the relevant local village or city. Playing the renewable energy sources has an effect on the scores for each role, and by working together a minimal total amount of points must be achieved. This is only achievable by forming coalitions and optimise the use of resources by mutual coordination at the scale level of the entire city or region.

Figure 1-5 Energy game with city council, civil servants and citizens in Utrechtse Heuvelrug, January 2019

The We-Energy Game raises awareness and provokes a discussion about how to start with the energy transition. Municipalities often have to change but often don't know how big this change can be. Getting their citizens and local businesses involved in the energy transition can be hard. This game shows not only the difficulty and complexity of the energy transition within their own city or region, but also the possibilities and opportunities. The Game is simple and easy to understand. It costs about an hour to play and is most of the time followed up by a discussion about the choices the participants made. Municipalities that played the game, found it very handy and said that they learned a lot by looking in a playful way at their territory and having a discussion with their stakeholders afterwards. However, only playing this game is not enough, so municipalities are recommended to continue this discussion with their stakeholders because only together they can figure out a way to make their city or region sustainable.

WHY?

A **well-organised local ecosystem promotes the successful preparation and realisation of plans** for smart cities and low energy districts in four ways:

- Specific **choices in behaviour** and lifestyles of citizens can contribute to realising the objectives of smart city and low energy district plans, possibly supported by and nudged by advanced ICT;
- Citizens have a say as (end)-users of buildings, utilities, energy, transport and ICT networks. As tenants and owners of buildings, their rights are enshrined in laws and regulations, and their **approval is vital** in processes as refurbishment. As end-users, they expect the same or better service levels. Citizens need to be informed and participate from the early phases of plan preparation. Co-design of the content of plans with other stakeholders, and co-creation during the implementation stage, accommodate citizen's rights and preferences, enlarge support for the plan, and contribute to its realisation.
- Due to different **ownership structures and operational licenses** in cities, in particular in countries where many public services have been privatised, urban stakeholders are highly dependent upon each other for successful preparation and implementation of a smart city plan, often relying on innovative procurement and novel business cases.
- **Good ideas of citizens and local businesses**, united in bottom-up initiatives, can be very powerful, but often need some form of facilitation by the local government.

Lack of proper stakeholder engagement at an early stage can result in cancelled or delayed projects, or in difficulties during implementation, due to lack of buy-in of some stakeholders.

TO DO 5:
CREATE SHARED KNOWLEDGE BASE

by exploring possible solutions for the problem(s) and issue(s) at stake together with key stakeholders

After the brainstorm with stakeholders for the previous TO DO, where different aspects and consequences of the problem(s) and issues (s) were discussed, the next TO DO entails that the city administration investigates **directions for possible solutions** with the same stakeholders, with the aim of determining their feasibility and viability. This step is necessary to prepare a collective agreement on the solutions and approaches in the future.

EXAMPLE: SOCIAL ACCEPTANCE OF ENERGY REFURBISHMENT

Social acceptance of energy refurbishment interventions should be an important focus of social-housing refurbishment projects. The effectiveness of interventions is based on both technologies and construction choices made and changes in energy consumption behaviour of households. Project partners should not take preferences and needs

of tenants for granted. An ad hoc survey should be designed and administered with the aim to collect information about the specific case study. Preferences and needs concerning behaviours, habits, knowledge and energy topics should be integrated in the organization and contents of information and consultation meeting (SINFONIA, 2015).

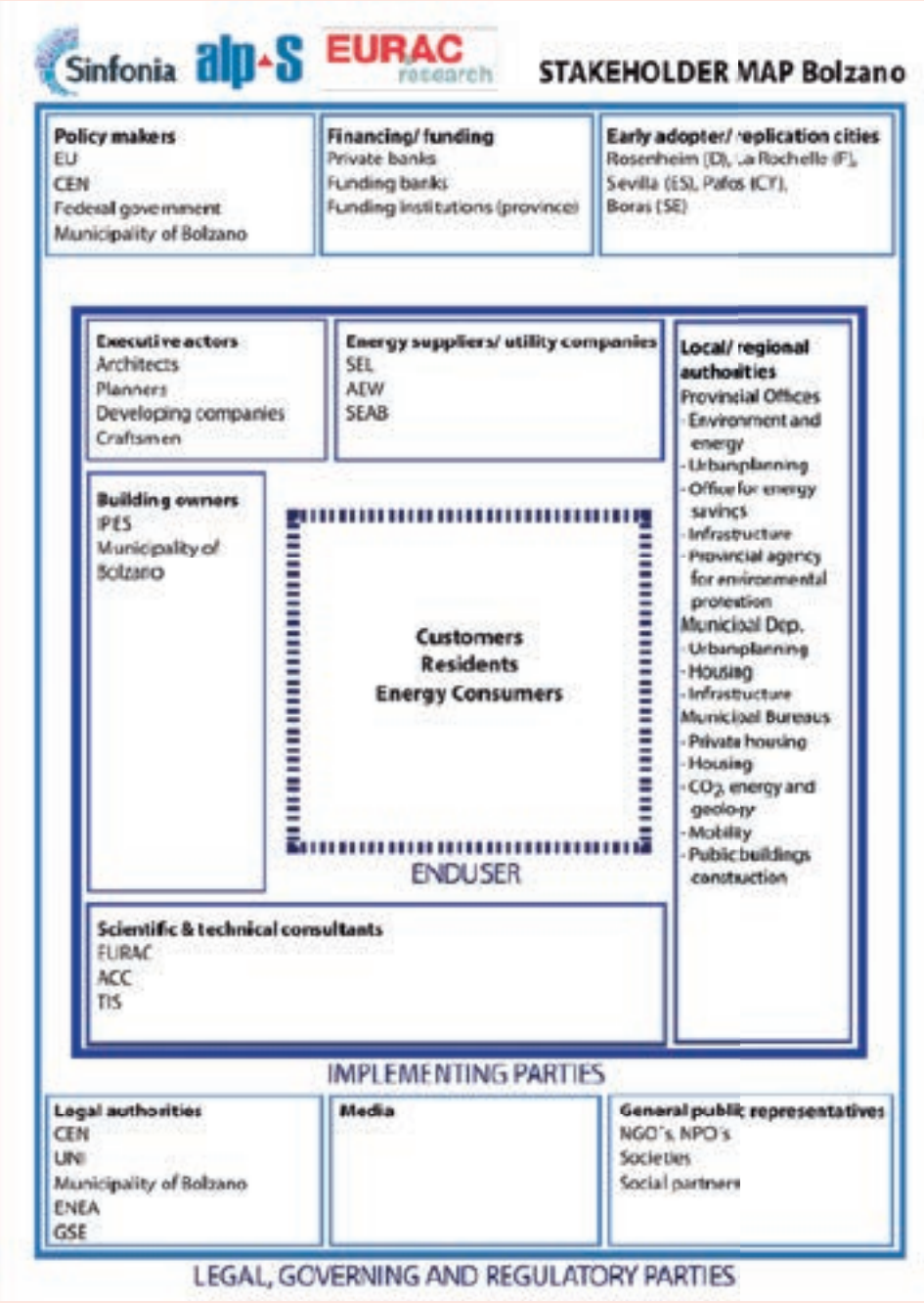


Figure 1-6 Stakeholder map for the City of Bolzano

Figure 1-7 Stakeholder engagement in Munich. Source: SmarterTogether. Photo credits: City of Vienna

EXAMPLE: In the SINFONIA project a stakeholder map for the activities in demo cities was drafted at the beginning of the project. Later on this was refined and specified. Based on this information, knowledge sharing activities were set up and further developed. (SINFONIA, 2015)

TO DO 6: EXPLORE LEGISLATION AND COMMITMENTS

by charting the preconditions and binding national and EU obligations following from these, which may influence the design of your solutions

The last TO DO implies that conditions following from current legislative frameworks and ongoing obligations from binding commitments must be investigated, as these determine what can be done and what the city administration is allowed to do, or what the city administration has to do anyway. This defines the **degrees of freedom in carving out new plans and activities under specific**

mandates or legal responsibilities. The resulting room for manoeuvre may lead to different choices in approach by the city administration and stakeholders when it comes to making the vision concrete.

This TO DO is also important because projects are planned within a specific **legislative and political context that might change**. These changes can result in new issues emerging, such as the need for new negotiations, reassessment of expectations, and adjustment of the intended project. Depending on the severity of the changes and their impact to the project, these can result in delays, postponement of implementation, or failure of the project. Therefore, any smart city or low energy district project plan should involve the **city administration as the main stakeholder and co-creator in the planning process**, responsible for safeguarding the vision at long term and for connecting to other related policy and decision-making processes. Both the process and the final project plan should be transparent and unambiguous about the scope and timeline, and any deviations from the original plan in future should be collaborative, approved by all stakeholders, and integrated into the project plan. Original and amended project plans must incorporate the political timeline into their possible risks, but these risks should be mitigated as much as possible by having a transparent, unambiguous, and consistent plan with approvals in place. In addition, the responsibility for smart city plans can be allocated to structures or organisations less vulnerable for political cycles. Finally, contracts and collaboration agreements can allow a time horizon longer than that of the political cycle.

WHY? The context within which the smart city and low energy district plans are prepared sets the stage for later project implementation.

Frequently smart city projects are prepared and carried out separately, without a proper connection to ongoing national or EU obligations the city administration has committed itself to and which are related in content, e.g. implementation of SE(C)AP, SUMP or laws. As a consequence, **synergies with these obligations are not exploited** and possible savings in financial or human resources do not materialise. Connecting the dots at an early stage leads to better anchoring of smart city and low energy district projects. It can also help to clarify how these obligations and the mandates or authorities coming with them, influence the design of a new project in terms of preconditions, stakeholder engagement, and responsibilities.

What is more, any relevant **changes in the political or regulatory landscape** can put the intended project at risk. Smart city projects with new or innovative solutions are generally considered more risky. Strong long-term political support is often a requirement for a successful project (Rivada et al., 2016).

The timelines of project planning and implementation may conflict, in duration, scale, or interval, with legislative cycles (Di Nucci, 2010). As many smart city projects may have **elements that certain political factions may find controversial**, the project may encounter an unexpected challenge, obstacle, or barrier due to changing laws or regulations, during one or more project phases. An example of such a legislative change mentioned in an interview, is that the introduction of GDPR legislation made telecom operators not willing to share GPS data on trips from mobile phones anymore, even not anonymised. As a result, the plan for creating better transport planning systems, had to be adjusted.

Very similar to legislative changes, **election cycles may run contrary to project cycles**. This can result in, for example, a municipal champion of a project (the mayor) being replaced by a politician with goals that are inconsistent with the project (DI Nucci, 2010), or the need to bring a new politician up to speed and gain their support for an ongoing project (CELSIUS, 2014).

1.4 Inspiration

This section describes various ways to develop smart city narratives and to translate these into plans ready for implementation by highlighting examples of the cities of La Spezia, San Sebastian, Bolzano and the Scottish Cities Alliance (see Garcia 2016).

Although the trajectories of La Spezia, San Sebastian, Bolzano and Scottish Cities Alliance have many elements in common, they emphasize different aspects of the process of drafting Smart City strategies and plans. La Spezia is an example of a predominantly bottom-up process where wide involvement of the local community quickly produced actions, which are later checked for feasibility, funding opportunities and alignment with current municipal plans. The examples of San Sebastian and Bolzano show how earlier European projects or participation in ambitious city networks

can lay the foundation for even more ambitious and integrated smart city plans, such as lighthouse projects, by organizing the quadruple helix collaboration and defining the local core elements for smart, energy-efficient neighbourhoods. Finally, Smart Cities Scotland shows how a common approach of seven cities can act as a catalyst to strategy and plan development and securing investments in each individual city, for example by identifying shared priorities between cities in a self-assessment process.

La Spezia

La Spezia is located in the north of Italy, close to Genua. The city administration developed two strategic plans (1999 and 2012) and developed in addition a series of sectoral plans aimed to a sustainable urban development. Among these, an Integrated Mobility Plan, a SEAP (SEAP) validated by the EC JRC in the frame of the Covenant of Mayors for Climate & Energy initiative in 2012, plans for broadband and Wi-Fi deployment and several urban regeneration plans. However, the economic crisis imposed to redesign a strategy for a long-term city development, with the need for an integrated and achievable strategy aiming at the recovery of competitiveness. The integrated approach should combine urban innovation, urban regeneration, energy efficiency, sustainable mobility, social housing, and smart cities and communities, as a result of both bottom-up (community driven) and top-down (municipal smart governance) policies.

Key elements of the process were involvement and participation, use of innovative technologies, and public-private partnerships. An extensive participatory process in spring 2015 involved more than 100 local organisations, universities and industry, and focused on the specialization sectors of the region. Participation was organized around five thematic tables of qualified stakeholders: Smart Mobility, Technology of the Sea and Environment, Smart Environment, Smart Economy, and Living & People. Together the participants created an inspiring mind map (figure 1-9).

The Master Plan was approved in November 2015. Subsequently, in Phase 2 between January and September 2016, the feasibility of the proposed actions was checked in order to start building projects with the actors:

- Experimental forms of public-private partnership and to organise funding for the development of the actions proposed;
- Making choices in line with the market, but also with the development strategies of the city;
- Maintaining the sharing and co-planning method even at the stage of project development;
- Focusing on human capital and territorial excellences.

In this way, long-term aims were translated into proper short-term actions, summarised in the LA SPEZIA 20.20 plan. After that, the next steps in Phase 3 focused on the definition of projects, with clear technical and financial feasibility of the proposed actions, continuity with actions already taken (coherence), synergy with the transversal themes (sea, tourism, ICT), availability of progressive investments, creation

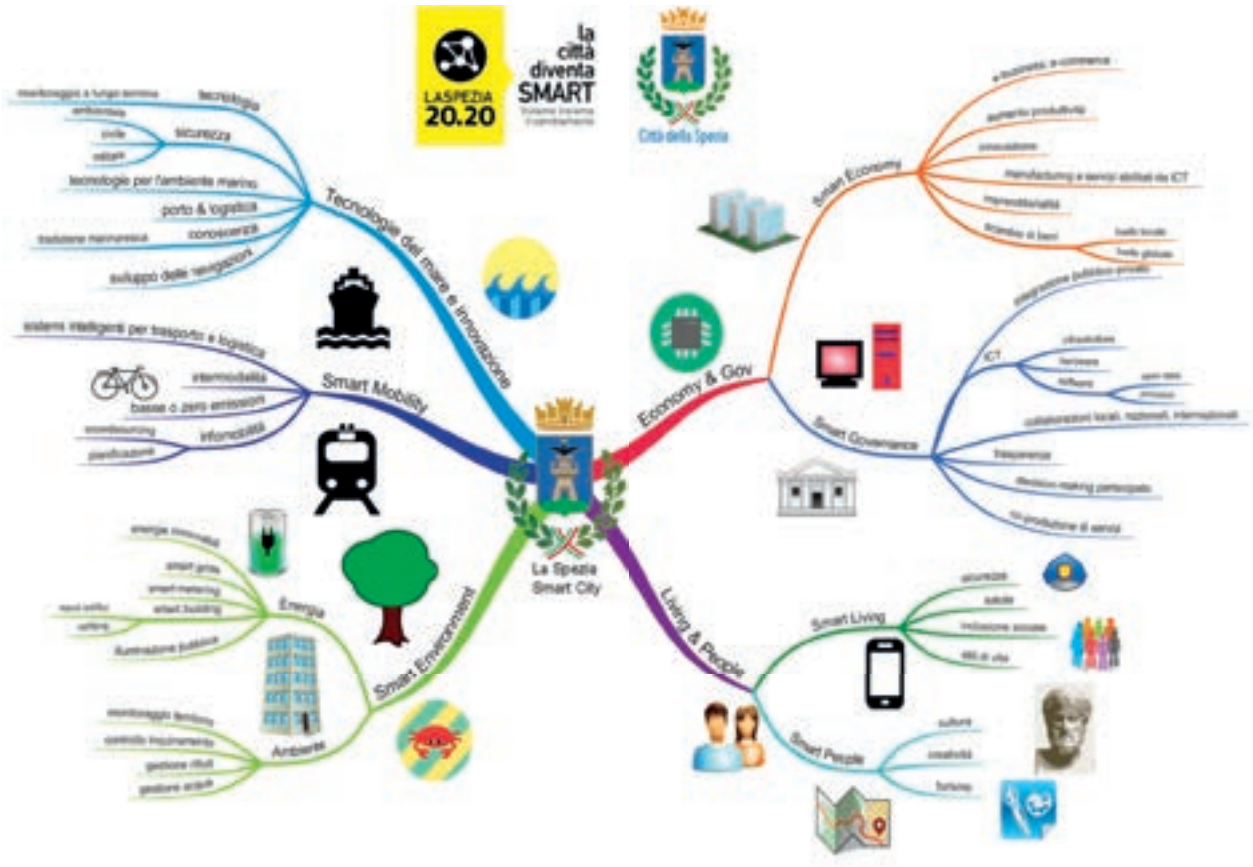


Figure 1-8 La Spezia 20.20 involves the local stakeholders around five thematic tables and creates a mind-map. Source: La Spezia

of partnerships, awareness and responsibility by each referent and its working group.

At this stage, La Spezia needed funds for implementation of the plans, but also knowledge: financial and contractual expertise (for instance on pre-commercial procurement), and case studies and lessons learnt by other local bodies. A couple of projects were started. After local elections in 2017, the new Municipal Board has continued the participative process started with La Spezia 2020, but because the envisaged projects were already well-defined or going on, some projects have been continued and new ones have been started. For example, in the environmental field in the context of the fight against climate change, ERDF funding has been concentrated on projects financed both by regional planning (Plan of reduction of hydrogeological risks) and by territorial cooperation (Project Adapt - Interreg Maritime). On the Mobility front, the integrated and sustainable vision was collected in the new SUMP and presented a smart moblity project to the Ministry of Transport. Regarding Smart Economy, a Laboratory for Economic Development (with associations, universities and research subjects) has been created and it is focusing on the issue of circular economy applied to nautical industry. Around the Smart Government topic, some projects have been financed by the objective thematic “Digital Agenda” of the regional ERDF operational program.

San Sebastian

Donostia - San Sebastian, located in the North of Spain, developed an integrated planning process in the city and converted it into strategic projects (see Garcia 2016). The planning process started following the methodology defined earlier in the FP7 project STEEP – Systems Thinking for Efficient Energy Planning, together with the cities of Bristol (UK) and Florence (Italy) (STEEP, 2015). The development of the Smart City Plan involved all the municipal departments, but also 187 people from 96 different organisations (companies, universities, R&D centres, regional government bodies, and citizens). The process had two main goals:

- A main strategic line with shared objectives.
- Coherence (consistency) and Coordination in the Public Action.

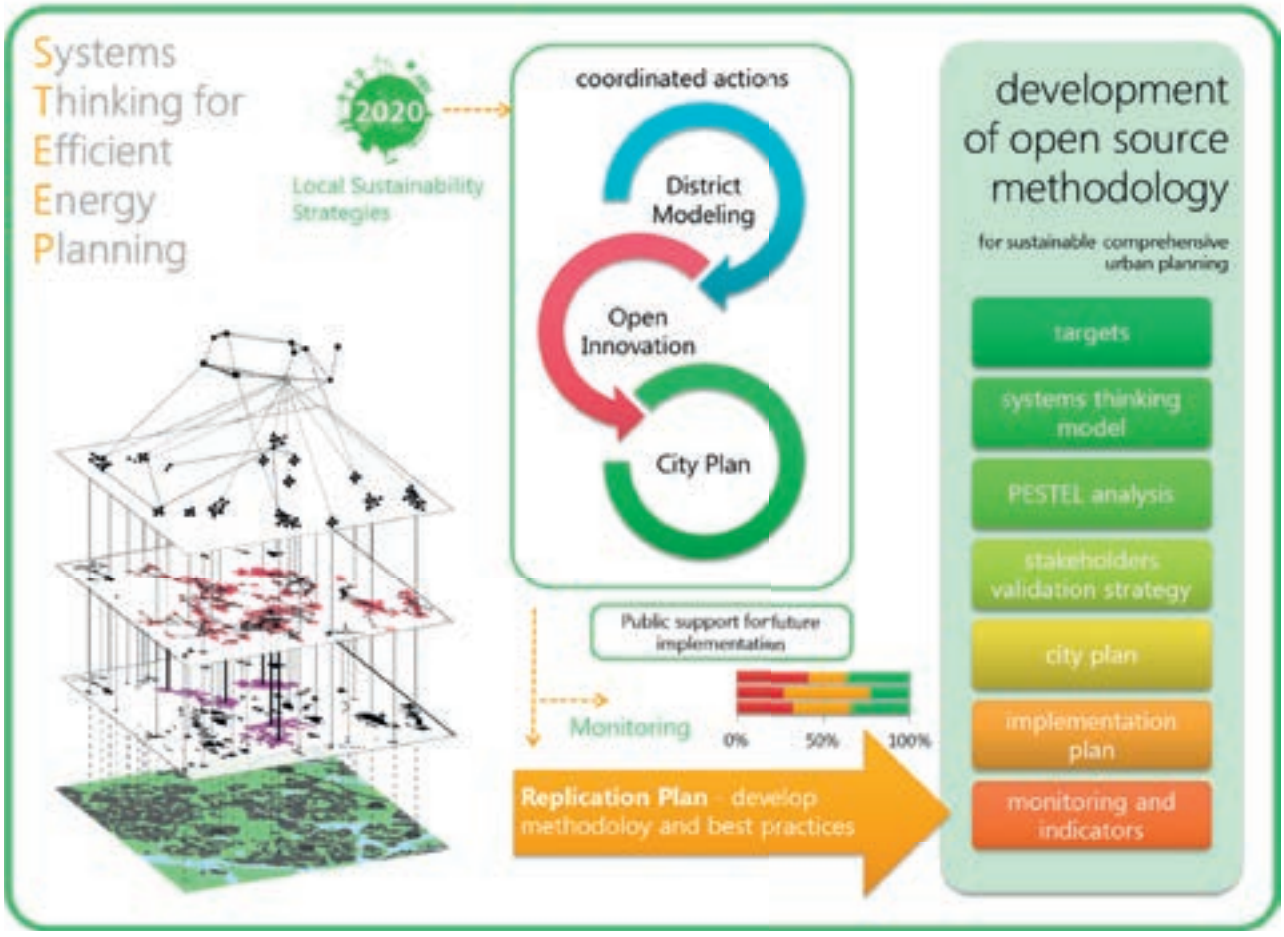


Figure 1-9 Outlook of the methodology defined in the FP7 STEEP project. Source: STEEP

The process defined several strategic projects, including among them the URUMEA RIVER SIDE project that focused on an area with social, territorial and mobility challenges. The city administration selected the project to apply for funding as a lighthouse project in HORIZON 2020 SCC-01 call of 2015 and succeeded as the best valued project of this call with the proposal REPLICATE, again together with the cities of Bristol and Florence. This provided the chance to implement the ideas for smart city and low energy district projects developed earlier during STEEP project, see figure 1-11. What is more, San Sebastian developed meanwhile a comprehensive smart city strategy (Fomento San Sebastian, 2015).

Figure 1-10. San Sebastian process, from planning (STEEP) to implementation. Source: REPLICATE

Smart Cities Scotland

Since 2011, the Scottish Cities Alliance involves seven Scottish cities: Glasgow (the biggest one with near 500k inhabitants), Edinburgh, Aberdeen, Inverness, Dundee, Perth and Stirling (the smallest) and the Scottish Government. None of the seven cities are big, so they need collaboration. Scotland's "Agenda for Cities" from March 2016 has the objective of maximising the impact of cities as economic drivers of growth. The agenda is delivered through the Scottish Alliance Operational Plan priorities:

- Low Carbon
- Infrastructure
- Smart Cities

The operations priorities focus on innovative solutions and attracting investments, and work to create an environment to test new ideas, technologies and businesses. Collaboration across the seven cities is a need. ERDF funds were used to develop a common plan. It is interesting to see how this process was organised for all seven cities, as this form of regional collaboration proved to be very successful.

First of all the Alliance has performed a self-assessment process for planning, thus identifying the priorities shared between the cities. The process has followed the NESTA "City initiatives for technology, innovation & entrepreneurship (CITIE) Scotland analysis. Each city has identified its level of Maturity on Strategic Intent, Data, Technology, Governance & Service Delivery Models and Citizen & Business Engagement, leading to the identification of opportunities (see figure 1-12).

Following the development of a collaborative strategy, the brand Smart Cities Scotland has been created, widening the market size for smart city projects in Scotland and promoting the unique inter-city approach to develop Smart City solutions.

Furthermore, the ERDF-funded first phase of "Scotland's 8th City – the Smart City" Programme was launched to boost investments (public and private) and to assist the cities to make savings and achieve better outcomes via effective citizen-led innovation. One of the outcomes has been a blueprint for involved cities with suggestions for actions to be taken (Scottish Cities Alliance, 2016).

December 2018, an additional 15 million euros have been devoted by ERDF to the second phase of the programme, bringing the total investment in smart city projects to 60 million. The funds will be mainly spent to finance actions which foster the creation of new technologies, transforming the delivery of city services within the framework of this "**Scotland's 8th City – The Smart City Strategic Intervention"** programme. Its projects target a substantial development of smart technologies such as: mobile working (application for business data sharing), IoT (infrastructure projects for data sharing

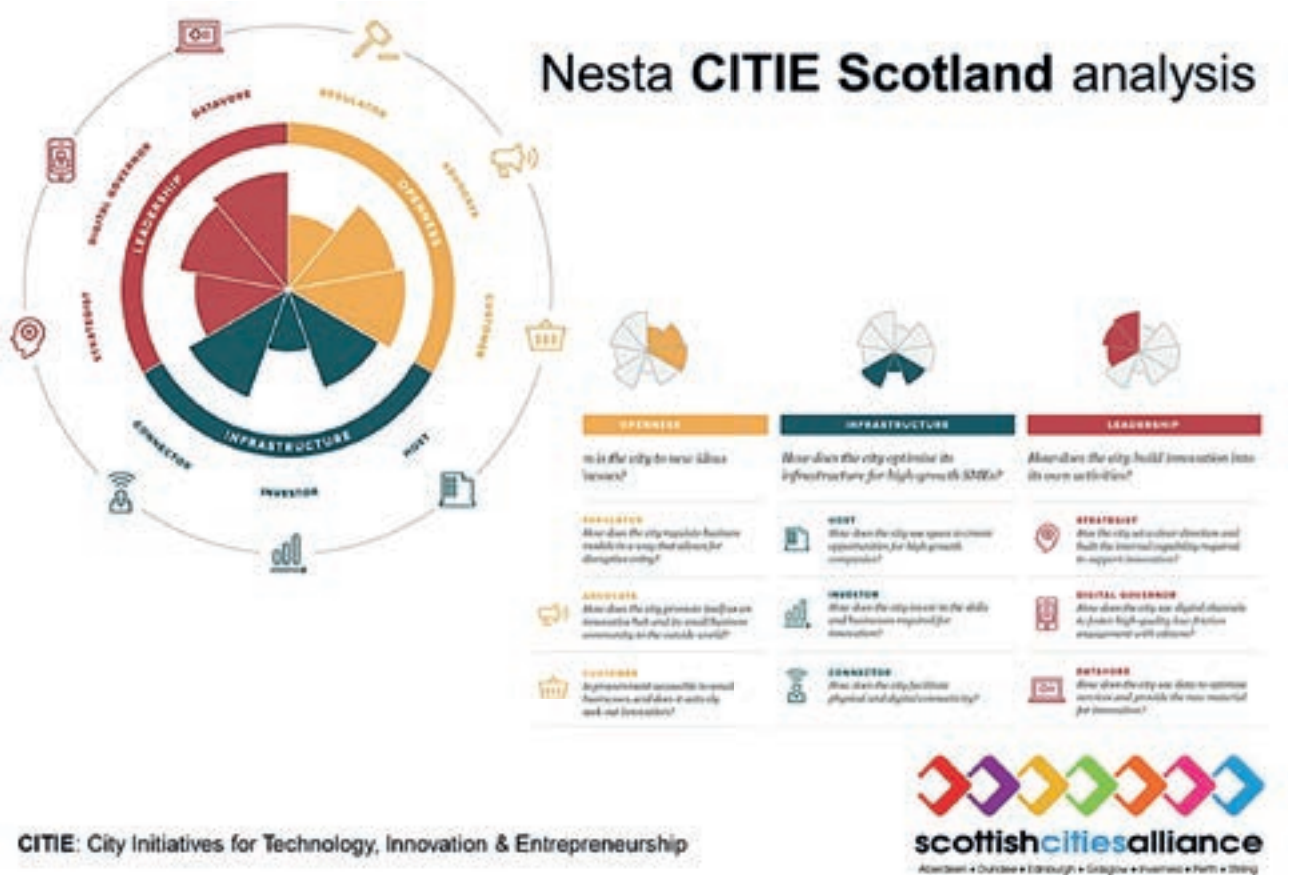


Figure 1-11. Overview of the Nesta CITIE nine policy roles that are the basis for the analysis. Source: Nesta

to reduce operational costs), seven cities data platforms (same standard of quality for data from each city platform) smart waste management, energy and mobility. The City of Glasgow is leading this programme, while demonstrating itself innovative, smart city solutions in a lighthouse project in Ruggedised SCC-01 project.

Bolzano

The City of Bolzano, 105.000 inhabitants and located in the north of Italy, developed its smart city vision by working on several milestones. The first milestone was Bolzano's selection as "Alpine Town of the Year" in 2009, thanks to its commitment to achieving local carbon dioxide emission neutrality in the near future. In the same year, the city was, together with other 200 European cities, among the first signatories and supporters of the Covenant of Mayors, a second milestone. Following, with the help of local research organisation EURAC's Institute for Renewable Energy, the municipality drafted the vision "Action plan for Bolzano CO_2 neutral" in 2010: a third milestone towards a smart city vision. EURAC has supported the city for several years in becoming cleaner, more liveable and smarter. The action plan specifies how to move towards the goal of carbon neutrality by specific actions, and by linking various urban strategic planning tools.

The development of the City of Bolzano is guided not only by traditional tools such as a building codes and urban zoning plans, but also by a master plan and a strategic plan, which interact at different levels with the issues related to energy and to urban development.

The Strategic Development Plan of the City of Bolzano "Ideas 2015 - Thinking about the City " can be considered as a fourth important milestone. It has examined the strengths and weaknesses of the city

and opportunities for the local community in four major thematic areas: society; culture and tourism; economy and employment; territory and environment. It aims to strengthen the existing positive trends, and find solutions to mitigate or reverse negative trends. In coordination with this, the Master Plan further specifies the organization of the territory and the structural contents, and is a reference framework for the development of a future Urban Planning Plan.

A fifth milestone was the approval of the SEAP in June 2014, which works in synergy and within the framework of the Masterplan's directives, with the latter having one section entirely dedicated to energy issues and the reduction of GHG emissions (Vaccaro et al., 2014). EURAC supported the development of this SEAP, while the research institute also prepared a research and innovation project on smart cities, funded by the 7th EU Research framework programme (FP7). This SINFONIA project is a five-year initiative to deploy large-scale, integrated and scalable energy solutions in mid-sized European cities. The cooperation between the two pilot cities Bolzano (IT) and Innsbruck (AT) is at the heart of the initiative. An integrated set of measures, combining the deep energy retrofitting of more than 100,000 sqm of living surface in social housing blocks, optimisation of the electricity grid, and the introduction of smart solutions for district heating and cooling, has achieved 40 to 50% primary energy savings and an increase in the share of renewables by 20% in two pioneer districts in both cities. Working at the "district level", involving people, and bridging the gap between demonstration and large-scale replication, are the essential points of SINFONIA (see figure 1-12).

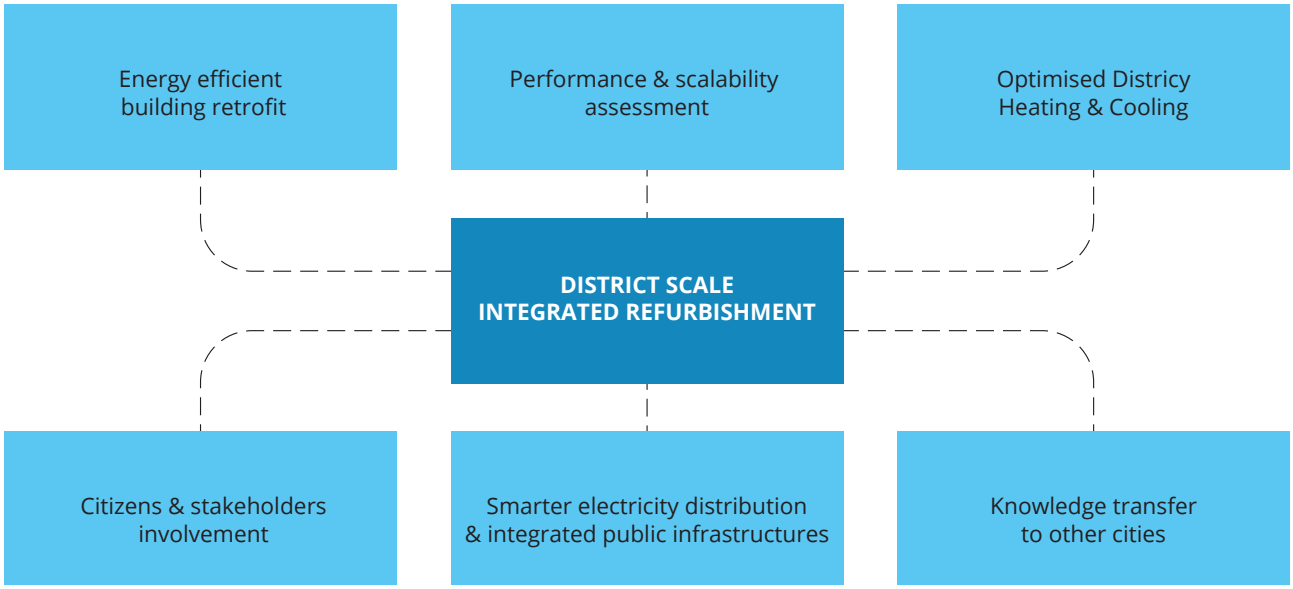


Figure 1-12. District integrated approach developed by the SINFONIA project. Source: Bisello & Vettorato (2018)

A large part of the project is therefore dedicated to the transferability and scalability of the solutions deployed in the two pioneer districts to other neighbourhoods in the same cities and to other urban contexts, as for example those represented by five follower cities around Europe: Pafos (CY), Rosenheim (DE), Seville (ES), La Rochelle (FR) and Borås (SE).

2 STAGE 2: THE VISION MADE CONCRETE

2.1 Background

This stage prepares the ground for making the detailed plan in the next stage. This is done by **operationalising the vision or a comparable plan** such as SE(C)AP from stage 1, further organising internal and external collaboration, and ensuring the financial and human resources for this preparatory phase. Per objective, a strategy is developed or a policy made that is translated into concrete ways forward. The way of working makes sure that not only the city administration but also key stakeholders agree on the road to go and which ways forward are most suited to realise this.

2.2 Checklist for the DECIDE & COMMIT stage

As said, this stage operationalises the vision or comparable long-term plan in a strategy and proposed actions for each of its objectives. The main question at this stage of **DECIDE & COMMIT** is: ***"How are we going to meet these long-term objectives by working out this vision in a strategy per objective?"***

To answer this question, a couple of TO DO's are to be checked. To start with, the generic vision or comparable long-term plan must be translated into strategy, policies and timeframe per objective. This indicates roughly the direction to go. Subsequently, the roles of main stakeholders should be defined more precise by consulting them. After this, it must be made sure that the proposed strategies and policies are well-aligned with other local targets or local general long-term plans, such as the Sustainable Energy (and Climate) Action Plans developed under the Covenant of Mayors for Climate and Energy, and regional, national, EU and UN targets as SDGs.

Following, concrete ways forward, or "routes", must be determined for each strategy and/or policy: ways forward to achieve the targets of strategy and/or policy. After that, the most promising "routes" should be jointly prioritised, together with the stakeholders. This might lead to a couple of iterations within this TO DO, or going back to previous TO DO's in this stage. Once the concrete actions are chosen, the next TO DO is to ensure that the city administration and the key stakeholders allocate resources for further development and preparation of plans, at this stage mostly capacity. Consecutively, internal and external teams should be formed by engaging different departments, organizing interdepartmental collaboration to overcome siloes, and capacity building. Finally, at this stage, a first exploration of different financial schemes and possibilities is needed.

Commonly used **tools** for the **DECIDE & COMMIT** stage are regular interdepartmental meetings, workshops and sessions, innovative brainstorming methods, i.e. tree of knowledge, best practice benchmarking, consultation of city networks as ICLEI and Eurocities, field trips and site visits, conference visits, financial readiness check, assignments to consultants, collaboration with local universities or research institutes, and capacity-building activities or tools provided by the Covenant of Mayors for Climate and energy (including the interactive funding guide available at https://www.covenantofMayors.eu/support/funding.html). For setting the priorities the Baseline Emissions Inventory developed as a part of the SECAPs, provides an indication of the sectors emitting most of the GHG/CO_2 emissions in the cities. **Standards** which can support the stage of **DECIDE & COMMIT** are ISO 37100 Terms and Definition, ISO 37101 Quality Management Systems Approach, ISO 37105 Description of Cities, ISO 37106 Strategies for Long-term Vision.

Eventually, the TO DO's of this stage result in commitment of city and stakeholders on the strategy and priority of selected actions.

Figure 2-1 Checklist of TO DO's at the DECIDE & COMMIT stage

STAGE 2:
DECIDE & COMMIT

Question:

How are we going to meet these long-term objectives by working out this vision in a smart city strategy or policy per objective?

TO DO 1: TRANSLATE THE GENERIC VISION

into a strategy and/or policies, policies and timeframe per objective, supported by high-level leadership in the city administration

TO DO 2: DETAIL THE ROLES OF STAKEHOLDERS

by agreeing on responsibilities during the preparation phase, start preparing PPP's, recruiting local endorsers

TO DO 3: RE-ALIGN SMART CITY GOALS, AMBITIONS AND POLICIES

with other local targets and overall long term city plan, and with regional, national, EU and UN targets

TO DO 4: JOINTLY PRIORITISE ROUTES WITHIN EACH STRATEGY AND POLICY

by selecting and ranking routes

TO DO 5: ALLOCATE RESOURCES FOR THE PREPARATION OF PLANS

by city administration and stakeholders, at this stage mainly capacity

TO DO 6: FORM INTERNAL AND EXTERNAL TEAMS

by engaging different departments, creating an institutional framework and finding vehicles for capacity building

TO DO 7: EXPLORE DIFFERENT FINANCIAL SCHEMES

in terms of preconditions and possibilities

Tools & standards

TOOLS:

- regular interdepartmental meetings and workshops
- innovative brainstorming methods
- best practice benchmarking
- consultation of city networks
- field trips and site visits
- conference visits
- financial readiness check
- assignments to consultants
- collaboration with local research partners as universities

STANDARDS:

- ISO 37100 Terms and Definition
- ISO 37101 Quality Management Systems Approach
- ISO 37105 Description of Cities
- ISO 37106 Strategies for Long Term Vision

Output:

Commitment of city and stakeholders on the strategy or policy and priority of routes

2.3 How?

The first TO DO is that the generic vision or comparable long-term plan has to be translated into strategy and/or policies and timeframe per objective. This indicates roughly the direction to go and which solutions could be contemplated. For example, if the objective of the vision is to reduce local air pollution levels by a smart city project, it is evident that this objective can be achieved in different ways. Healthier transport modes such as walking and cycling might be encouraged by closing roads for car traffic, e-buses could be made mandatory in concessions for public transport, intelligent transport systems can use sensor data to lower the speed of traffic resulting in lower emissions, and travel by personal car can be made much more expensive by introducing road pricing or toll systems. **Per objective, a preliminary strategy and/or policy must be established, accompanied by a defined timeframe**, for discussion with key stakeholders later in this **DECIDE & COMMIT** stage.

TO DO 1: TRANSLATE THE GENERIC VISION

into a strategy and/or policies, policies and timeframe per objective, supported by high-level leadership in the city administration

This will usually be done in interdepartmental meetings, workshops, and brainstorm sessions, supported by assignments to consultants or collaboration with local research partners. Field trips and site visits can help to gain an overview of solid approaches and good examples.

Support by high-level leadership is crucial for this TO DO. A committed person or group within the city administration, such as the (Deputy-)Mayor, a Councillor or Director of Unit, must champion the cause and facilitate the process from planning to implementation. This commitment of municipal support helps to reduce the perception of risk, attract investors and partners, and engages the public.

An important pre-condition for **high-level leadership** is for smart city projects to fit within the overall city strategy or vision, as proposed by this roadmap in the **VISION stage**. This requires timely engagement and buy-in at the highest political levels through information and education, and explicit approval in the city council on official policy documents such as a smart city or low energy district strategy (so not only support at the level of practitioners). Therefore, the narrative of the envisaged project should **highlight positive effects** that relate to the **overall goals of the current political landscape** (e.g. economics, jobs, tourism). In addition, indirect benefits and co-benefits which can be expected from the contemplated directions, such as less air pollution, lower operational costs of infrastructures, or less congestion, can help to make the case. If the contemplated directions are too ambitious, innovative, or demanding for the current political landscape, it is wise to start with smaller, less ambitious (or controversial) projects, and work up to larger-scale, aspirational projects afterwards. Getting approval for a small living lab, for example, might garner enough support and attention that larger projects within the city could become more viable.

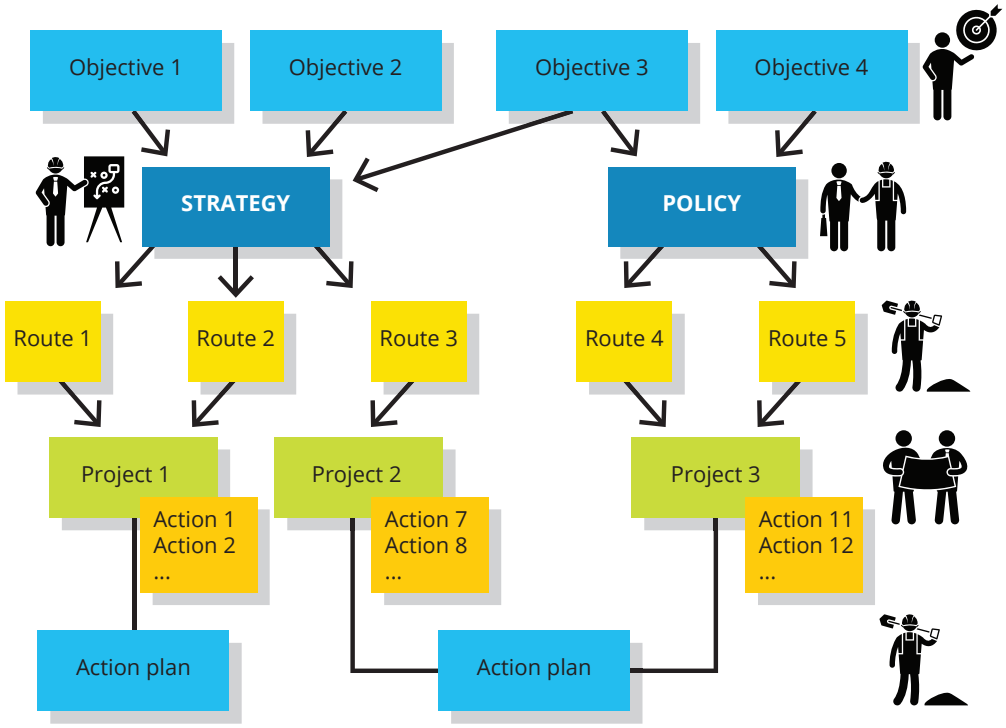


Figure 2-2 Relation between strategies or policies per objective, routes, projects and action plans in this roadmap

EXAMPLE: "Regarding projects' prerequisite of needing strong political support, trials and industry–led mechanisms can help to increase confidence of decision makers. De-risking interventions by academic and industry-supported trials and having a housing provider management receptive to be a test bed of solutions goes much of the way to alleviating this unease. The emergence of long-term guarantees in terms of performance of solutions is one response that has already opened the door to the wider adoption of low energy solutions such as deep retrofitting of homes" (adapted from Rivada et al., 2016).

WHY? This TO DO is a first step in **working out different approaches**, which need to be discussed, revised and adjusted later in the process, in dialogue with the city administration itself, and key stakeholders including citizens and local businesses.

As smart city projects are generally considered riskier, strong political support is often a requirement for a successful project (Rivada et al, 2016). Insufficient political will and high-level leadership can provide another layer to the challenge, especially if the project requires municipal support in the form of staff capacity or policy changes (BEEM-UP, 2014). The need to have a political champion to push for change was illustrated by interviewed staff: "citizen focus is in the focus of the Mayor - she is going to all of the districts and really reaching out to the citizens, and talking with them, and also have an conversation to see what are the needs of the citizens" (Interviewee #5, 2017).

TO DO 2: DETAIL THE ROLES OF STAKEHOLDERS

by agreeing on responsibilities during the preparation phase, start preparing PPP's, recruiting local endorsers

Following, the next TO DO focuses on **bringing more detail in the respective roles of all key stakeholders**. The city administration must identify these roles more precisely and consult in depth with stakeholders about the strategy and/or policies proposed in the previous TO DO and their implications for day-to-day operations, living environment, finances, etc. of the stakeholders. During this stage, it is important to **reach an agreement on the responsibilities of all key stakeholders for the preparatory phase of the project**. Possibly, more formal forms of collaboration can already be explored, for instance by starting to prepare PPP's. Besides, recruitment of ambassadors and local heroes who are willing to endorse the overall vision and strategies or policies, will help to create public support for them.

EXAMPLE: STIMULATING ACTIVE PARTICIPATION OF STAKEHOLDERS

The SmarterLabs project, funded by JPI Urban Europe, charted important preconditions for proper stakeholder engagement. Creating ownership of all stakeholders and people involved in a dedicated process, sets cornerstones for later acceleration of the impact that is generated in an experimental smart, sustainable cities project. Bringing all stakeholders together from the beginning, collecting their ideas and listening to them while explaining the objective of scaling up or replicating the results at the end of the project right, is crucial. A moderated and clear process must be set up, in which the acceleration of the impact generated in the experimental project, is stressed right from the start of the project. Active participation of citizens and other organisations is by no means a given, and initially participants might need to be attracted to actively participate in the project and receive some form of reward. The understanding should be that participants are experts in their lifeworld, street and neighbourhood. Therefore, an adequate monetary compensation might be needed. In cases such as Paris and Madrid, using participatory budgeting had shown to be very useful to stimulate active participation. Also, individuals and associations while act as multipliers can widen the circle of engagement to better understand complex settings and generate more robust and innovative knowledge and urban sociotechnical development. Knowledge brokers, who are well anchored in the neighbourhood/street/district where the project is conducted, know the urban actors and the community as well as public administration can provide the links between the different project partners in an experimental project. However, Active participation of citizens and other organisations is by no means a given, and participants might need to be attracted to actively participate in the project and receive some form of reward such as monetary compensation or participatory budgeting (SmarterLabs, 2019).

WHY? The buy-in of key stakeholders is needed for successful integrated planning and implementation of smart city and low energy district projects. This commitment is needed from the start of the plan, to ensure that the actions that are eventually proposed, are co-designed and co-created with these stakeholders. This intermediary step is **needed to prepare the ground for this co-design and co-creation**, as formal and legal responsibilities of involved stakeholders might influence the feasibility of proposed strategies and policies, while the interests of the key stakeholders need to be aligned with those of the city administration.

TO DO 3: RE-ALIGN SMART CITY GOALS, AMBITIONS AND POLICIES

with other local targets and overall long term city plan, and with regional, national, EU and UN targets

In the **VISION** stage, the legislative framework and binding national and European commitments have been explored. Now the strategies and/or policies have been defined in more detail per objective, and their timeframe is known, it is time to **ensure again that these strategies and policies are properly (re-)aligned with other local targets and local plans**, such as the Sustainable Energy (and Climate) Action Plans developed under the Covenant of Mayors for Climate and Energy, and regional, national, EU UN targets, such as the SDGs. In the case of SE(C)APs, the added value of this methodology related to those plans could be that this roadmap not only ensures capacity and enlarges the scope, but also helps to tackle behaviour in an integrated way. Exchange and communication with the regional level and with metropolitan areas (in case the city collaborates formally at agglomeration level), on the intended strategies and policies is essential for this TO DO. Often investments in smart operations of urban infrastructures and public transport or decisions on smart (re)development of urban areas are taken or approved at this level.

EXAMPLE: SYSTEMS THINKING FOR ENERGY AND SMART CITY PLANNING

The STEEP Methodology uses a form of systems modelling known as a Hierarchical Process Model (HPM) to develop a shared understanding by the problem owners about how to achieve the transformation. The conceptual model can be developed by the owners of the transformation in a facilitated group model building workshop, or by a systems expert interviewing the owners, or a mixture of both (see example below), and has been applied in FP/ STEEP and SCC-01 REPLICATE projects. The system model is designed to help with decision making and therefore the processes can be evaluated for performance using evidence from stakeholders.

A colour scheme is used; green for a process performing well, red for processes performing badly, and white where there is little or no information about performance. The arrangement of green, white and red leads to its colloquial label of an Italian Flag. For each process that is labelled mostly red there is a clear need to act to improve its performance. For processes that are labelled mostly white then there is a

need to find out more about what is happening or what needs to be done. For these 'issue' processes options must be developed to address them in order to improve the overall performance of the system. The stakeholders can debate arguments for and against each option, or vote on them, until a decision is made about which options to implement.

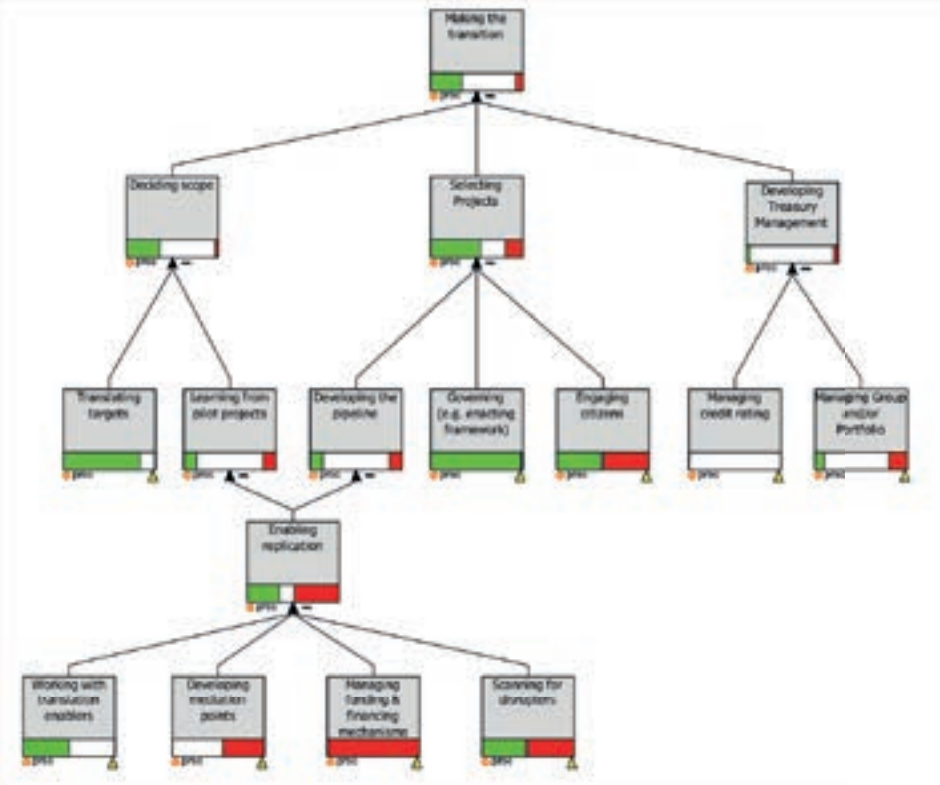


Figure 2-3 Figure 1. System model and example of a performance evaluation produced by a systems modeller in the REPLICATE project. This is a system designed to achieve the transformation described in the text. Each sub-process below the top-level process provides more detail about how to achieve the process. Two immediate actions are apparent from the Italian Flag scoring of processes i) the <Managing funding & financing mechanisms> process needs to be improved, and ii) the <Managing credit rating> process is completely uncertain and needs some work to research how to implement this process. Note that the model and the evidence is only for illustration purposes. Source: SmartSteep (2019)

Thus, a group is able to work through the process of deciding a transformation and how it might be achieved leading to an 'action plan'. It is expected that this methodology is adopted as a continuous and ongoing process whilst the transformation is underway, rather than just used once at the start; the action plan being updated to reflect tasks completed, learning – which would lead to changes to the structure of the system model, and revised evidence about performance e.g. tasks completed should lead to processes becoming 'green'. The approach can be implemented using the conventional props of flipcharts and post-it notes in face-to-face workshops. An experimental online system is available for working groups to continue developing system models and action plans (so-called same-time/different-places workshops) (SmartSTEEP, 2019).

WHY? A couple of reasons make this TO DO necessary. Firstly, if this alignment does not take place, **potential synergies with other objectives, plans and policies might go undetected** and thus unexploited. In the worst case, the intended smart city or low energy district strategy and/or policies, might even counteract other policies. The opposite case, where other policies overlap to some extent with the intended smart city and low energy district strategies and/or policies, offers great opportunities for mutual collaboration, but if this collaboration is not taking place, it may lead to **less efficient processes** and a waste of financial and human resources. Now the strategy and/or policies per objective have been defined, it can be more actively pursued to identify and exploit potential synergies and mutual benefits following from specific choices, not only on solutions but also on organisational aspects.

TO DO 4: JOINTLY PRIORITISE ROUTES WITHIN EACH STRATEGY AND POLICY

by selecting and ranking routes

After the specific roles and responsibilities of city administration and key stakeholders have been agreed upon and public-private collaboration loosely organised earlier at the stage of **DECIDE & COMMIT**, the time has come to **make the strategies and/or policies more concrete** by bringing all of the different stakeholders together toward one or more common goals, shared understanding and **collective agreement on the routes or pathways to follow**. This can be done by organising a couple of repeating cycles, where each time the same steps are made to arrive at a list of prioritised "routes" within each strategy or policy, agreed upon by the key stakeholders. The main criteria for this first selection and ordering of these "routes" are usually the current situation, expected impact, financial aspects, and maturity and expected feasibility of the proposed route(s).

It might occur that the lack of incentives or the existence of disincentives for specific sectors of city administration or for key stakeholders, hampers this process of achieving collective agreement. In many cases a smart city project is attempting to tackle a problem which is for the public good, but it may go against the self-interests or profitability of stakeholders, for example existing service providers. The proposed strategy and policies can change current value chains of businesses, and can pose threats or opportunities. By **giving a voice to key stakeholders, and engaging them in co-designing and co-producing the eventual solutions from the viewpoint of their own interests**, the city administration ensures public support for the actions per strategy or policy ultimately proposed.

Different solutions can help to provide better incentives for different stakeholders, such as adjustment of existing business models, for example for energy network operators, through diversification, or offering new services in neighbourhoods. Other solutions are to increase the size of the market through agreements with the collective sector and facilitation of grass roots initiatives, such as collective ownership by citizens of wind turbines or solar plants.

EXAMPLE: WHOLE-BUILDING LOW ENERGY RETROFIT AND CONNECTION TO THE DISTRICT HEATING NETWORK

"The existing approach (the old way) is that the city provides grants and each owner had to do all the work, coordinating everything themselves with both the city and the private contractors and providers. The new way involves a tie-in between the administration and the private companies. So the government pays for the retrofitting action, and then the building owner pays back the government. This provides peace of mind – by dealing with the government and not a private (for-profit) company, by not dealing directly with businesses. For building owners, the #1 challenge is the complexity of the process, with no guarantee of results. They need to do everything themselves, and then connect to a network provided by a private company. This also involves cultural issues – the distrust of the unknown, fear of change and loss of control, of something going wrong (risks of innovation). The government backing provides security and peace of mind. It also forces the city government and public administration to rethink energy and heat supplies. It moves the concept from being about private companies selling a product, to supplying a service" (Interviewee #7, 2017).

EXAMPLE ALTERNATIVE BUSINESS MODELS TO SECURE ENERGY SUPPLY

"...energy suppliers are adopting alternative business models that secure energy supply to a customer while implementing renewable generation technologies. Examples are utilities supporting homeowners with loans for small scale PV and wind installations. Firms however must use alternate means to finance renewable energy projects without direct help of public energy utilities " (R2CITIES, 2014).

WHY? It should be realised that in most of the situations where smart city and low energy district plans want to make changes, **there are already actors in play** for whom the most advantageous scenario is continuation of the business-as-usual scenario. This also includes the dilemma of service providers and increased efficiency – whereby for example a successful energy efficiency project results in a change in demand, and a resulting decrease in supply (and loss of profit) for the energy provider. "Most of the major energy companies are publicly owned, causing an unresolvable conflict of interest between profitability and pursuit of political benefits through popular, social pricing policy" (BEEM-UP, 2014). Whether public or private, these energy retailers have a clear conflict of interest (and disincentive) to help their clients reduce their energy consumption (R2CITIES, 2014).

"... it is also the energy company - of course they participate in all this innovation, but if it is to save CO_2 there's also a conflict of interest - they need a new business model for their business ... they need to investigate a new business model, so sometimes companies are not so open and I understand this... they are not so transparent because it might be their future business model, and we as a city would like

to ... have figures and numbers and evaluation and sometimes they say "well, data is our future, our business model" maybe, so sometimes it's a little bit difficult for us to evaluate those new technologies" (Interviewee #5, 2017).

In other cases, the **incentives may be less obviously problematic, but may still provide challenges to the implementation of smart city and low energy district projects**, such as the UK tax code, which prioritizes new construction over renovation of existing residential buildings (EFFESUS, 2017).

TO DO 5: ALLOCATE RESOURCES FOR THE PREPARATION OF PLANS

by city administration and stakeholders, at this stage mainly capacity

The next TO DO entails **allocation of resources** by the city administration and each key stakeholder **for further development and elaboration of plans**: at this stage mostly capacity. It is not yet about finances for the implementation itself, but for preparation.

EXAMPLE: PUBLIC AUTHORITY AS A CATALYSER

Integrated planning, in parallel with the co-production approach developed in the STEEP project, makes it possible to enhance public investments by acting as a catalyser for private investments in cities (STEEP, 2015). This co-production approach, based on system thinking methodology, has also been used in the Horizon2020 SCC-01 REPLICATE project. The City of Florence, one of the main partners in STEEP and REPLICATE, developed a smart city plan a few years ago (City of Florence, 2015). The city administration experienced that the sustainability of the plan is mainly based on two coordinated actions: direct sustainability and derivative sustainability. Direct financing is linked to the spending power of the city administration under the new provisions on harmonised budgeting and reinforced financial reporting, as well as to the spending restrictions imposed by the so called "Stability Pact", so that only very few significant infrastructures can be actually built and implemented. For example, the construction of the new tram lines inaugurated in February 2019 prevents the simultaneous development of other works, and this virtually eliminates the possibility of obtaining significant results in energy efficiency indicators associated with a reduction of emissions and polluting agents. A combination of funding using regional ERDF has appeared to be an innovative mechanism.

The use of indirect financing may be the answer to the "economic limits" of the City and a guarantee for achievement of pre-set goals. If, for example, pricing policies can be a tool for maintaining and developing strategies, also to convey and reinforce the meaning of the choice made, the decision of a private entity to invest in the actions proposed by the city administration with calls for tenders is the result of a careful assessment of the opportunities offered and the consequent implications both in terms of economic attractiveness (PPP/ESCO) and of result and visibility (crowd-funding).

In addition to the investments for the actual implementation of the action, i.e. the physical construction or renovation of an infrastructure (tramway), and political strategies with a direct impact on citizens/residents/tourists/city users (eco-road pricing policies, town planning), there are equally significant choices made by the city administration which directly affect the city administration itself and are good practices. For example, the Smart City Plan can be seen as a container for collecting the suggestions of other European countries that can also be used in Florence, essentially by the city administration. This should be the objective of Green Public Procurement (GPP), the policy of environment-friendly buying and the increasing activity of analysis and assessment of the opportunities offered by EU programmes and funds for regional development directly linked to the theme of smart cities.

WHY? **Preparation of plans for smart cities and low energy districts is time-consuming**.

To be able to draft the plan, it must be clear which resources can be committed to this, not only by the city administration, but also by involved stakeholders. For example, several interventions show the potential of partnerships in buildings retrofitting (through energy saving companies-ESCOs) or transport (with OEM's), etc. But it is also true that PPP's are not always the only answer. For instance, in many cities, municipal companies are playing the role of investors and operators in energy projects and managing the city's broadband networks and transport infrastructures.

TO DO 6: FORM INTERNAL AND EXTERNAL TEAMS

by engaging different departments, creating an institutional framework and finding vehicles for capacity building

This step focuses on setting up the team(s) which will prepare the plans for smart city and low energy district projects. Usually each key stakeholder puts together a small team which has a specific mandate for the preparatory phase (external teams). Due to its normally central role, the city administration will often set up a larger team consisting of staff from different departments (internal team). Citizens and local businesses can participate individually, send representatives or organise themselves in a more formal structure, for example by establishing a neighbourhood or user association, or a business community. Common activities at this step are **engaging different departments, formalising interdepartmental collaboration to breach the siloes, and create an institutional framework and vehicle for capacity building in public-private partnerships**. The latter can be done by creation with stakeholders of a joint smart city "brand", a specific, connective approach to smart cities and low energy districts, geared to the city needs, and often in the form of a PPP.

During this step, one repeatedly encounters the problem of **siloes**, not only in governments, but also in businesses. Projects on smart city and low energy districts are often managed by vertically structured departments (silos) in the local government or similarly, sectors in businesses. Other project stakeholders, including local businesses, solution providers, and universities, are frequently siloed as well. Since no single department or sector has the full mandate (or ability) to implement a holistically

designed project, this can lead to long negotiations, and delays or postponement of implementation of the project.

Within the city administration**, internal collaboration issues can be prevented** by the clear definition of a person or entity (a system integrator) in charge of horizontal co-ordination with sufficient responsibilities and mandate. Successful co-ordination would require the establishment of truly multi- or inter-disciplinary teams. This approach will need to be adapted to each instance, as there is no standardized organisational structure for municipalities or their agencies. Some approaches to overcoming siloes initiated by cities include:

- Installing cross-sector departments (New York City);
- Creating "special staff units" reporting directly to the politicians (Ludwigsburg);
- Installing informal interdepartmental working groups (Freiburg);
- Outsourcing this task to semi- independent project management companies (Vienna).

Another approach is to collect and aggregate the different city infrastructure data streams and control operations in a single structure - an operations centre. Co-located services and employees from different departments, working together, may act as a "nerve centre" to facilitate co-ordination and communication, breaking down some of the walls of administrative silos (ECOSOC, 2016).

The problem of siloed organisations can be aggravated by **differences in work place culture and organisational structures.** This may cause conflicts and challenges for a smart city project, especially with the ad hoc sort of organisation developed specifically to bring together a wide range of partners for a temporary project. Such incompatibilities in workplace culture differences, should be handled with strong project management before they become important issues that can compromise the project. Ground rules should be set regarding expectations and defining the project work culture, including risk management, contingency planning and rules for escalation. Further, **staff training in the field of smart cities and low energy districts, next to the development of a common language and thinking**, e.g. by a glossary, can help establish a level playing field within a project team, especially when project members come from highly diverse disciplines. Engagement of other parties in triple or quadruple helix collaboration can help to foster a joint (work) culture, to stimulate a higher quality in co-design and co-creation, and to harvest local knowledge of the area to be transformed. And last but not least, many successfully implemented smart city and low energy district plans have paid ample attention to social activities, in combination with educational, training and work activities, physically located in the plan area.

EXAMPLE: ONE PHYSICAL WORKSPACE AND IN-HOUSE HIGH-LEVEL EXPERTISE

"Bristol in the U.K." has "given senior executives a broad smart city mandate. Bristol is also breaking down silos between different departments in the municipality. To save money on real estate and improve co-ordination, the local authority is planning to co-locate nine teams in one space, which should help the city adopt new sensing technologies on a citywide scale. Bristol is also making sure it has high-level expertise in-house, primarily to ensure it doesn't become heavily reliant on a single vendor or systems integrator. 'The local authority has been astute enough to hire people with quite sophisticated technology and procurement backgrounds,' said Paul Wilson, managing director of Bristol Is Open, the smart city unit for Bristol. 'We know our strategy and we will go to vendors to fulfil aspects of our strategy. We have the intelligence to know what our plan is, and we are in charge. That is very important for a city or it will be blown around in the wind of vendor games.'" (Pringle, 2016a).

EXAMPLE: APPOINT A CHIEF TECHNOLOGY OFFICER FOR THE CITY

"In March 2014, Amsterdam created the role of chief technology officer (CTO). The role is responsible for breaking down silos across the city government, setting overall strategic direction, providing a consistent face to external stakeholders and helping to navigate a complex political landscape" (Gibson et al., 2015).

EXAMPLE: OVERALL BUDGET LINKED TO OVERALL OBJECTIVES INSTEAD OF PER SECTOR

"At the moment we are establishing an overall strategy for the city that is linked with budget and that is very new - before we were sectoral - we had a sectoral approach.... mobility was a certain budget, and built environment was another budget, and now we are trying to have an overall system of objectives and goals, that everybody can decide on" *(Interviewee #5)*.

EXAMPLE: COHERENCE BY SHARED PROJECT PLANNING TOOLS AND PROXIMITY

"Shared project planning tools go some way to bring coherence to interaction between staff that rarely work together but an enabling structure is required in the management of projects that facilitates this joined-up working" 8. "Regarding silos and getting people to work together, physical proximity can be very helpful" "Get people working together by actually working together - in proximity to each other" "Communication is key" (Interviewee #1, 2017).

EXAMPLE: CLARIFY THE EXPECTED CONTRIBUTIONS AND ACCOUNTABILITY OF DEPARTMENTS

"Clarity of contribution and accountability of effort – SE(C)APs set specific targets but are rarely parcelled into the districts that municipal staff feels are manageable for district interventions. If departments' contributions were set out and their distribution of efforts were clarified, then staff and management in particular would feel less aggrieved that certain projects draw on resources that are likely already stretched" (Rivada et al., 2016).

EXAMPLE: TEAM STRUCTURE AND LINKS TO RELEVANT PARTS OF THE ORGANISATION

"The administrative structure of the team is also an important success factor. A team leader with adequate empowerment, and members with clear visions about their responsibilities will make it easier. The team members should also have links to relevant organisational structures (strategic planning, spatial planning, transportation, etc.)" (Interviewee #2, 2017; Stacey et al., 2016b)

EXAMPLE: INTERDEPARTMENTAL VEHICLES TO BRIDGE AND PREVENT SILOES

"It is basic and simple decision-making, definition of goals and the achievement of those rely on an exchange of knowledge. Consequently, strong efforts have to be made to create an environment of trust and mutual understanding, which is the most important prerequisite for a well-functioning and transparent knowledge transfer. In Bolzano as well as in Innsbruck exchange of knowledge is well coordinated and documented. The core of knowledge sharing in both demo cities is represented by the district teams, consisting of all local internal stakeholders. These local teams meet on a regular basis with a focus on knowledge exchange between the internal stakeholders" (SINFONIA, 2015).

WHY? "De-siloed" inter-departmental city internal co-ordination and communication are needed to address the multi-sectorial, interdisciplinary character of most smart city projects. This means that for a well-functioning local ecosystem, **not only external collaboration has to be organised, but also internal communication within cities.** The difficulty of getting different departments working together is a common problem experienced by many interviewees. The lack of horizontal co-ordination, co-operation, and collaboration, or acceptance between vertical departments is a well-known issue in organisations and projects, and a common problem in the implementation of smart city projects (OECD, 2016; BEEM-UP, 2014; R2CITIES 2016; ECOSOC, 2016). During implementation of integrated strategies and plans in siloed organisations, **no department generally has full mandate for achieving the targets**. This can lead to long negotiations, delays or even postponement of the implementation of the project. In addition, siloed organisational structures can involve many issues that complicate the implementation process itself later: information islands, the lack of an overall strategic vision, task fragmentation, and overlapping or blurred responsibilities. All of these can be a direct result of a lack of co-ordination and communication between departments.

"...it's an effort and an initial obstacle ... maybe in the beginning, for a city that is new to, or is working for the first time in this way. So, I think that it is necessary to follow this process and also compulsory to work in a co-ordinated way between all the municipal departments and to have this governance structure or co-ordination quite clear" (Interviewee #8, 2017).

Furthermore, the administrative structure and working culture may provide a source of conflict and present issues for the progress of the project. Variations and incompatibilities between structures and administrative interaction (hierarchical structures vs. flat structures) as well as supervisory and management styles (e.g. democratic, autocratic, teamwork, micro-management, etc.) are a common source of conflict in organisations, especially the ad-hoc sort of organisation developed for a temporary project. The administrative structure may also have a higher authority (i.e. funding agency) with which they may have to report progress or provide deliverables – which can present issues depending on perceptions regarding management style, as well as the frequency, type, and magnitude of reporting.

Differing work cultures can also create conflicts between project members and within project teams, causing issues for the advancement of the project. These may be related to differences between personalities, or specific corporate cultures, to the variability between regions and cultures within Europe.

One interviewee mentioned the difference between industry and research partners as an example of cultural differences. While composing the plan, the research partners want to be able to do research, and to have open information and access to property rights, while the industrial partners want to be able to sell solutions, the investment partners don't want to have anyone damaging their intellectual property rights and to prevent any infringement. This led to lengthy negotiations (Interviewee #6).

BERND KLASSEN, PROJECT COORDINATOR MUNICH

One of our big learnings from Smarter Together also was to experience that it makes sense to combine topics such as energy, mobility and technology within one project in order to prevent silo thinking and bring experts together. Most of the time a silo mentality does not derive from ill will but from lack of possibilities to work together. In the context of smart cities, exchanging ideas across these topics has proven very fruitful for us.

TO DO 7: EXPLORE DIFFERENT FINANCIAL SCHEMES

in terms of preconditions and possibilities

This TO DO entails a first exploration of suitable financial schemes and possibilities, with the aim of having a realistic understanding of the viability of the plan in terms of finance. **Financing instruments are a key part of integrated planning and management.** Instruments, and more specifically financial instruments, enable the realisation of smart city plans. Financial instruments foresee finance during integrated planning and management of smart city projects in various ways:

- Early-phase exploration of financial aspects of the plan;
- Risk assessment and feedback on financial feasibility during the preparation phase;

- Advice on financial models, and securing finance, when concretising the plan;
- Procurement, contracting, establishment of Public Private Partnerships (PPP's) or other Collaboration forms, which enable implementation;
- Monitoring of financial performance of the plan during implementation;
- Evaluation of financial performance after implementation;
- Recommendations on finance and possible adjustment of the chosen financial model.

The **economic viability of smart city and low energy district plans can be improved in several ways** (EIP-SCC 2013, 2014; eeef 2017). Foremost, demand should be bundled in order to create more attractive business cases. However, this upscaling is closely related to standardisation of smart city solutions. Standardised solutions provide better business cases as the potential markets are larger. Subsequently, novel business models, mixed funding and crowd funding can help to tap into previously unused sources of finance, in particular when firmly rooted in the local ecosystem of smart city partners, including local businesses, citizens and NGOs. Investments in smart assets can be used for lowering operational expenditures and other costs for partners, and investments from different stakeholders can be combined. Sometimes this requires the adjustment of the regulatory and legislative framework. PPP's can provide the structure for such mixed-financing investments (Placidi et al. 2016). Further, more innovative and faster procurement procedures with less uncertainties makes investments more attractive. And lastly, possible investors and funding resources should be involved from the concept phase of any smart city plan and project. Requirements need to be addressed together with the project scope and before structuring any call for tender and concession documentation, in particular with respect to the minimum investment size, blending options, and the financial maturity function of implemented measures (eeef 2017).

Further, **many residents may be unaware of financing options or opportunities** which may exist to help them with the financial costs of implementation of smart solutions or measures to save energy and use more renewable sources of energy. Therefore, promoting awareness of financial opportunities should be one of the first activities covered during project scoping. Opportunities for external help with private financing should be one of the mandatory activities in project planning. The project team should collect and evaluate those specific opportunities that apply to the project and target market. The project group should bundle, simplify, streamline, and support the application process for the target market.

In addition, several portals and digital catalogues need to inform about financing opportunities for cities at European level, see for example the **financial guides of the Covenant of Mayors for Climate and Energy and the EIP-SCC Action Cluster Business models**. Most regions and countries have helpdesks which provide information about loans and grants, for example the Managing Authorities for European Structural and Innovation Funds. At local level, more and more cities have implemented the one-stop shop concept for information on energy saving measures and clean energy production and offers for implementation. The Chambers of Commerce can play a role in advising local businesses on these matters.

EXAMPLE: INTERACTIVE FUNDING GUIDE OF COVENANT OF MAYORS FOR CLIMATE AND ENERGY

Within Europe, there is a wide range of regional, national and European financing and funding possibilities for smart city and low energy district plans. Figure 2-4 gives an overview of the financing and funding possibilities within Europe.

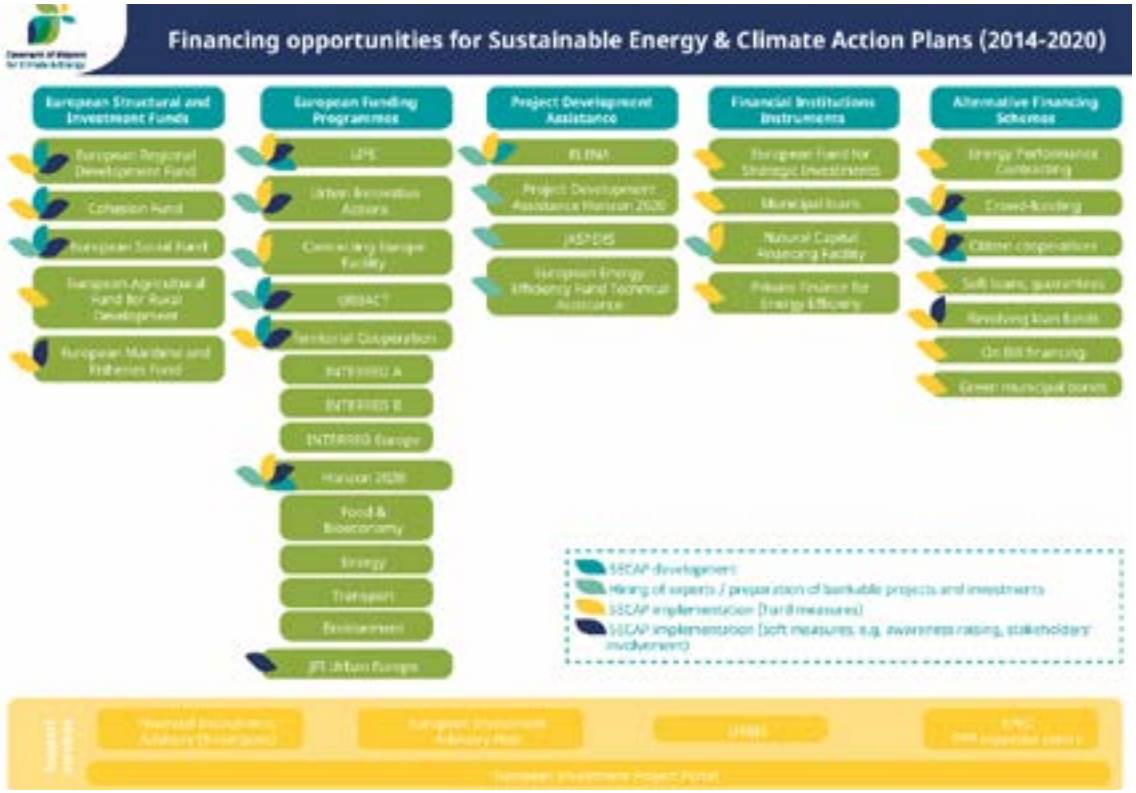


Figure 2-4. Overview of financing and funding opportunities for smart city projects in Europe (Source: Covenant of Mayors for Climate and Energy and Eurocities)

Further, the EIP-SCC Funding Guide provides clear and practical information, about the opportunities that European Funding Programmes offer to enhance the development of smart sustainable solutions both in cities and regions. It has been developed by the Action Cluster Business Models in collaboration with the Covenant of Mayors and targets all the stakeholders in the smart cities arena.

This interactive tool gathers relevant information about the main European funding initiatives such as the European Structural Investment Funds, the European Investment Bank's financial instruments and several programmes managed by the EC and Member States. By using the different filtering options, the user will be able to identify the most appropriate opportunities for their project ideas. More information can be found on: http://eu-smartcities.eu/funding-page. In addition, the Covenant of Mayors interactive funding guide gathers information in 23 languages on the funding initiatives for local climate and energy actions managed by the European Union, the Member States and key financial institutions, see https://www.covenantofMayors.eu/support/funding.html.

EXAMPLES: ONE-STOP SHOP FOR BUILDING OWNERS

In the Netherlands, 25 municipalities in the Rijnmond and Haaglanden Regions around Rotterdam and The Hague collaborate on more sustainable housing in the one-stop shop WoonWijzerWinkel. At the physical location of the shop, building owners are informed about a wide range of measures, their costs and subsidies. Special meetings and tours are organised on specific technologies. At low costs, interested building owners can get general advice, a technical check of the building, detailed tailor-made advice for the building, and quotations from more than 150 companies for its realisation. Specific (subsidised) actions for districts aim to bundle demand and lower the price per building (WoonWijzer Winkel, 2019).

WHY? Many cities and other urban stakeholders have **difficulties in securing finance for smart city and low energy district plans** (EIP-SCC 2013, 2014; eeef 2017) as the economic viability of the plans is not always self-evident for various reasons. Local government and other local public bodies usually have a limited budget. In addition, aging infrastructures and buildings might need renovation while new systems, devices and networks can be costly. In addition, the demand is still scarce and fragmented. Singular tailor-made plans are relatively expensive, thus not attractive to the financial sector. What is more, policy uncertainty can be a prohibitive factor for potential investors, as are long public procurement processes, subject to several uncertainties as well. Finally, the fact that funding is usually considered as the last step and often comes on board when the plan is about to be implemented and just lacks the finance, does not help either.

Government support may also vary throughout the duration of the project. Many municipalities have a budget planning timeline that runs on a different scale than the project itself, making long-term planning challenging. Finance and funding mechanisms also may run on a different timeline scale than both the municipal budgets or the project investment, "creating a quickly changing funding landscape" whereby financial and funding schemes change often - even annually (EFFESUS, 2017). This is often visible in, for example, the negotiation of an annual budget when trying to include long-term investments in retrofit, renovation, or refurbishment (Di Nucci 2010; Rivada et al., 2016). As insufficient external financial support and funding for project activities may hinder or even stop the process (Mosannenzadeh et al., 2017), exploration of financial schemes at an early stage is mandatory. What is more, different schemes come with different preconditions and responsibilities, so their exploration needs to be completed in time before the actual plan is made. For all these reasons, if possible, city administrations and other government levels, have to make a long-term commitment to a stable funding landscape in order to build trust.

More specifically for citizens and local businesses, for financial instruments available to them, such as rebates and subsidies, there may be many opportunities for both upfront and longer term financial help available, but **citizens and businesses are often unaware of them**, due to the fragmented, inconsistent, or unclear nature of their source, conditions and marketing. In addition, the large amount of different subsidies, premiums, tax rebates, etc., each with their own conditions, often confuses consumers (HERON, 2016; R2CITIES, 2014).

3 STAGE 3: PREPARE THE PLAN(S)

3.1 Background

This chapter discusses in depth the actual preparation of the plan(s) for smart city and low energy district projects. During the stage of **DECIDE & COMMIT** the city and the key stakeholders have agreed on the global strategy and /or policies, and prioritised specific "routes" or pathways. They also committed resources to start the preparation of the project. At the **PLAN** stage, the envisaged and prioritised actions are operationalised by choosing approaches, technologies and financial models.

3.2 Checklist for the PLAN stage

The **PLAN** stage makes the prioritised "routes" operational and defines them more narrowly, by setting targets and milestones, allocating responsibilities and creating a portfolio of projects. It also establishes an urban platform for information and knowledge exchange, both internally and externally. The **key question** at this stage is **"What are appropriate action plans or projects for implementing the strategies and policies agreed upon in the previous stage?".**

During the **PLAN** stage, a sequence of ten TO DO's leads to validated, ranked and operationalised action plans or projects, and topics for subcontracting. At first, milestones and concrete targets have to be defined, and responsibilities for achieving them have to be clearly delegated to specific departments or staff within the city administration ("who does what?"). Subsequently, the state-of-the-art of relevant and applicable approaches, methods and technologies, should be investigated. Usually this TO DO is initiated or led by the city administration, but it can be outsourced to a consultant, a RTO, or a university. Following, stakeholders should be consulted on the contemplated solutions in its broadest sense (approaches, methods and technologies). It might be needed to re-engage the stakeholders, as some time might have elapsed since they were consulted in the **DECIDE & COMMIT** stage.

After that, more spatial detail is added to the envisaged actions by analysing where in the built environment the problems are most pressing and where the potential impact of solutions could be maximized. Based on this new information, a preliminary long list of relevant on-going and possible new projects in transport, energy efficiency and RES, infrastructures and ICT, can be drafted, together with key stakeholders, for instance as included in the Sustainable Energy and Climate Actions Plans developed under the Covenant of Mayors for Climate & Energy. Consecutively, the investment and operational costs are worked out in more detail, and preferred sources of and models for finance and funding are chosen.

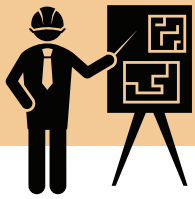
Again, projects on the preliminary long list are ranked according to their viability and the most viable and mature projects are selected, usually after a couple of reiterations. Successive political approval of the selected projects and explicit commitment to them by the key stakeholders, ensure that the proposed projects are sufficiently supported. One of the last steps, is the monitoring of progress during implementation which must be prepared by considering performance indicators, covering also the wider impact of the proposed project for society at large. Lastly, procurement and contracting can be prepared by selecting the main topics and/or preferred public-private partnerships for realising the aims of the project or action plan.

Eventually, by following these steps, the **PLAN** stage produces: validated, ranked and operationalised action plans or projects for smart and sustainable cities and low energy districts, plus the main topics and preconditions for realisation of the plans through (sub)contracting and procurement, or own contributions of the city and its partners.

Commonly used **tools** during the **PLAN** stage are: 1) SEAP and SECAP (to be validated by Joint Research Centre); 2) European Energy Award method to define a portfolio of projects; 3) open sources;

Figure 3-1 Checklist of TO DO's at the PLAN stage

STAGE 3: PLAN



Question:

What are appropriate action plans or projects for implementing the strategies and policies agreed upon in the previous stage?

TO DO 1: SET MILESTONES AND TARGETS
and agree on responsibilities, who does what

TO DO 2: EXPLORE STATE-OF-THE-ART OF RELEVANT AND APPLICABLE METHODS AND TECHNOLOGIES
internal and external

TO DO 3: RECONNECT TO STAKEHOLDERS
communication and consultation on envisaged actions

TO DO 4: VISUALISE LOCAL CHALLENGES AND POTENTIAL IMPACT
of prospective methods and technologies in neighbourhoods

TO DO 5: DRAFT A LIST OF RELEVANT ON-GOING AND POSSIBLE NEW PROJECTS
with stakeholders

TO DO 6: ELABORATE COSTS AND RISK MITIGATION, CHOOSE FINANCIAL SCHEMES AND SOURCES
by financial readiness checks and financial model(s)

TO DO 7: RANK AND SHORT-LIST PROJECTS
according to their viability and select the best projects

TO DO 8: ENSURE APPROVAL AND COMMITMENT
for selected projects by city administration and stakeholders

TO DO 9: PREPARE THE MONITORING PROCESS
by considering KPI's for targets and co-benefits

TO DO 10: PREPARE IMPLEMENTATION
through own finance and funding, contracting, public procurement and PPPs

Output:

validated, ranked and operationalised action plans, and topics for subcontracting

Tools & standards

TOOLS:

- SEAP and SECAP
- European Energy Award method to define a portfolio of projects
- open sources
- self-assessment tools
- dashboards
- CONCERTO method for co-design
- SINFONIA method for charting co-benefits
- CIVITAS model process for SUMPs
- ESPRESSO maturity check
- traditional project management tools as CEM
- PRINCE
- workshops
- direct consultations
- maps and 3D visualisation
- assignments to consultants and researchers
- study visits

STANDARDS:

- ISO 37106 Multi-sectorial Strategies for Cities
- ISO 3712X Targets with Indicators
- ISO 3715X Infrastructure
- ISO 37101 Quality Management Systems Approach,
- CityKeys KPI framework

4) self-assessment tools (i.e. NESTA Scotland methodology); 5) dashboards; 6) CONCERTO method for co-design; 7) SINFONIA method for charting co-benefits; 8) CIVITAS model process for SUMPs; 9) ESPRESSO maturity check; 10) traditional project management tools as CEM, PRINCE methods for project management; 11) workshops; 12) maps and 3D visualisations; and 13) assignments to consultants and researchers. Relevant **standards** are ISO 37106 Multi-sectorial Strategies for Cities, ISO 3712X Targets with Indicators, ISO 3715X Infrastructure, ISO 37101 Quality Management Systems Approach, CityKeys KPI framework.

3.3 How?

The first TO DO is **to define milestones and concrete, effective targets for the strategy and/or policies per objective** from the **DECIDE & COMMIT** stage. Subsequently, within the city's administration and the wider stakeholder network, a division or roles has to be arranged, **making specific departments or staff positions responsible for achieving particular milestones and targets** ("Who does what"). This is usually done by internal meetings and workshops, and informal consultation with stakeholders.

TO DO 1: SET MILESTONES AND TARGETS

and agree on responsibilities, who does what

WHY? This TO DO helps to **work in an efficient, effective and SMART way** towards execution of the strategies and/or policies as prepared in the plan. SMART as defined in management, meaning Specific, Measurable, Attainable, Relevant, Time-bound (see O'Neil and Conzemius, 2006). In addition, it is needed to **avoid confusion over who has (final) responsibility** for achieving the agreed milestones and targets.

TO DO 2: EXPLORE STATE-OF-THE-ART OF RELEVANT AND APPLICABLE METHODS AND TECHNOLOGIES

internal and external

The second TO DO is to explore, **make overviews of, and study the state-of-the-art in relevant methods and technologies**, which might be contemplated for the action plan. These methods and technologies must be assessed on their appropriateness for the local situation in terms of densities, building or infrastructure characteristics, mobility patterns, legislative context, etc. Specific preconditions for contemplated solutions need to be checked as well, for example with respect to GDPR. This can be done by the city administration itself, if competences are present, by internal and external pre-consultation of experts, engineers, consultants, research organisations on technologies and methods the city wants to deploy.

EXAMPLE: CO-OPERATION WITH LOCAL RESEARCHERS ON ASSESSMENT OF DEMONSTRATED SMART CITY SOLUTIONS FOR FELLOW CITY BRNO

Brno asked its RUGGEDISED project partner - SIX Research Centre from Brno University of Technology - to deliver expert analyses on six concrete topics related to smart urban development: smart thermal grids, smart power grids and e-mobilty, ICT, safety and security, smart waste management, sharing economy, and mobility. Each analysis describes solutions currently demonstrated, mostly in RUGGEDISED lighthouse projects, and summarises relevant worldwide and European trends. The analysis also makes specific recommendations of best practices for the Brno city, in particular for its replication of the area within Špitálka district. These expert analyses will serve as the basis for planning and designing a new smart city district in Brno. SIX Research Centre will follow up on these studies with co-ordination and organisation of expert roundtable discussions in the second half of 2019. The results from these roundtable discussions will help the city administration of Brno to proceed with specification of which concrete smart solutions will be used in future site development. Nevertheless, this is only a small part of Brno's co-operation with partners from the local academic sector. There is a lively collaboration based on projects like JRGL, Brno Ph.D. Talent on the academic capacity building and many others. The development of the programme Smart City Vouchers, dealing with the new ways of Pro-innovation Public Procurement are now in the preparation phase (City of Brno, 2019).

EXAMPLE: URBAN DATA PLATFORM BUSINESS MODEL CANVASS

Many cities struggle with progressing their platforms beyond Open Data platforms. They also struggle to engage with the private sector, especially because it is not easy to make a business case for a platform of which the value growth over time is not yet predictable. The Urban Data Platform (UDP) Canvass helps policy makers to take a long-term and comprehensive view on how to use data in their city, and how to foster (societal) innovation and citizen engagement. The UDP Business Model Canvass has been developed specifically for the design of Urban Data Platform initiatives. It combines a triple bottom line with business model elements that drive sustainable/ societal business models. Triple bottom line refers to the fact that an UDP does not only have financial costs and benefits, but also social and environmental costs and benefits. Elements that capture the platform and societal nature of an UDP are "Leading Public Values" (NB not value), "Scope and Reach" and "Platform Data Assets". The cities in Horizon2020 SCC-01 Ruggedised project are applying this instrument, for example for assessing district heating refurbishment in Glasgow.

The UDP Business Model Canvass has been developed from the position that government should take the lead in the development, management and ownership of Urban Data Platforms, as governments mostly do in case of vital infrastructures.

As a planning tool it helps policy makers to take a long-term and comprehensive view on how to use data in their city, and how to foster (societal) innovation and citizen engagement. The Urban Data Platform Business Model Canvass helps city officials to make an informed decision on why and how to take the lead in the development, ownership and management of UPDs and how to engage with stakeholders in their city ecosystem (Erasmus University et al., 2019)

Mission Statement for Urban Data Platform: Create public and private value thru Ecosystem Matchmaking

Partners Investor / Owner Governor vs Manager Technology / (Social) Media Partner Subcontractor	**Platform Activities** Tools & services, Matching, Audience building, Rules and standards, (Data) quality assurance **Platform Data Assets** Data-acquisition, data gathering, exploitation/mining, data analytics, visualisation / 3D digital twin **Key Infrastructure & Resources** Digital, Physical, Monetary, People, IP, Brand	**Value Proposition** "Place" for innovation, participation, collaboration, and public and private value creation	**Guiding Public Values** Platform purpose that engages all stakeholders **Scope and Reach** Open-closed, Local-global, Interoperability Access	**Customers, Users & Participants** Citizens, Communities, Companies, Start-ups, Developers, Data providers and platforms, Government, NGOs
Financial Cost E.g. investments, run costs			**Financial Benefit** E.g. ROI, revenue streams	
Social Cost E.g. privacy, security, freedom			**Social Benefit** E.g. democratic participation, growth, improved living conditions	
Environmental Cost E.g. carbon footprint platform ecosystem			**Environmental Benefit** E.g. sustainable innovation, reduced CO2 emissions	

Figure 3-2 Structure of UDP Business Model Canvass as developed in Ruggedised. Source: Ruggedised/Erasmus University (2019)

WHY?

This step provides an **orientation on how to achieve the proposed milestones and targets practically seen by exploring the suitability and applicability of different methods and technologies.** Besides, having an overview of which solutions could be part of the plan, supports a transparent discussion with local stakeholders on the pros and cons of choices later at the **PLAN** stage.

After the exploration of suitable methods and technologies in the previous TO DO, the next step is to actively continue and renew the communication with the key stakeholders. The purpose of these meetings and workshops is not only to **hear the opinion of the key stakeholders on the outcomes of the exploration of possible solutions of the key stakeholders, but also to start a dialogue about which solutions would suit the stakeholders' interests**.

TO DO 3: RECONNECT TO STAKEHOLDERS

communication and consultation on envisaged actions

Normally stakeholders have already been engaged for specific TO DO's in earlier stages, however, as the "routes" prioritised earlier become more narrowly defined and worked out in more detail into actions, it is of utmost importance to keep the stakeholders engaged and (re)connect with them on a regular basis. A mistake made often, is to engage stakeholders at the start of the preparation of plans, but not anymore at a later stage, what might lead to a less positive attitude towards the plan.

City administrations should consult all local stakeholders, including citizens and local businesses, in a proper way by keeping in mind that:

- ***Stakeholders might not be aware of specific issues deemed important by the city administration, or might have other priorities***

  Energy efficiency might not be the main concern of stakeholders and users of buildings and urban infrastructure, however, expected savings on energy costs are often an important motivation for agreement to plans for smart city and low energy district projects. For example, when buildings are refurbished to increase their energy efficiency, savings on the energy bill with the added benefits of more indoor comfort and a better condition of the building, are an important motive to consent to the proposed actions (R2Cities, 2014).

  Motivation is also important for later use of the refurbished buildings, infrastructures or new services. For example, Yoldi (2017) stresses that user behaviour is a key issue for the eventual result of energy efficient buildings, because if end users are not willing or being able to use the technologies properly, this will lead to lower energy performance values. Communication, raising awareness and the training of the tenants or other users are considered as probably the most important factors to success.

  Realising that stakeholders might have different priorities than energy efficiency of their building, means that city administrations should also develop a specific approach towards households suffering from **energy poverty** or increased costs of clean mobility as part of the plan.

- ***Win-win situations must be created by including other benefits from the envisaged actions than savings and reduction of GHG emission in the plan, such as less air pollution, or enlarging the scope of the envisaged actions, such as better quality of the public space***

  For instance, the narrative of energy efficiency investments should include those attributes that the homeowner is likely to value, and be tailored in order to emphasize the direct co-benefits of the measures – including a higher living standard, increased comfort, improved aesthetics, enhanced lighting quality, healthier ventilation, and better acoustics, among others (City-zen, 2016; EASEE, 2012; Ferreira et al. 2015). Or, as one of the interviewed key players in the field of smart cities put it, "To engage with citizens, you need a compelling argument - not just what you do, but how you do it. You need to create a dialogue and answer the question: what's in it for me?".

  As "co-benefit" refers to any positive impact or effect that exceeds the primary policy or project goal, regardless if intentional or not. Communicating the broad range of expected co-benefits creates a positive attitude and makes it possible to include the wishes and hopes of many stakeholders, including those who are sceptical about climate-energy issues (Bisello and Vettorato, 2018).

- ***Allow some flexibility to adjust the potential solutions and envisaged actions;***

  As stakeholders might have different preferences, there should be sufficient room for adjustment of the plan to stakeholders' preferences.

- ***Create joint ownership of the plan***

  One interviewee explicitly mentions that a top-down approach should be avoided as it does not create joint ownership of the plan: "One important point is that I would rather not start a top-down initiative but I would take the people along before - maybe at the same time. So citizen participation helps to create ownership for the project, to make what's possibly visible - why is a smart city useful to them - it's not just technological gadgets but it is supporting their quality of life " (Interviewee #5, 2017).

EXAMPLE: CREATE OWNERSHIP DURING THE PLANNING PHASE

"Co-operation with the homeowners and tenants to tailor the energy efficiency solutions to suit their requirements has been recognised in the EU-GUGLE project in order to best meet the ambitious sustainability goals. The involvement of the occupants during the planning and post-occupancy stages gives each person involved a greater sense of belonging and motivation to meet the collective goal of energy savings by adapting their own behaviour" (Morishita, 2017).

EXAMPLE: OPINION IN SOCIAL CIRCLES MATTERS DURING DEMONSTRATION

People tend to trust the opinions of their social circle as well as their own direct experiences, and demonstration projects provide one way to influence these factors (HERON, 2016a). Demonstration projects and living labs can involve the public and allow them to develop their own awareness and motivations based on their own direct experiences, or those of their social circle, instead of words and papers.

EXAMPLE: PRE-REFURBISHMENT SURVEY ON ENERGY BEHAVIOUR

In the Bolzano demo case of SINFONIA project a pre-refurbishment survey was conducted in order to better understand tenants' current energy consumption behaviour in social housing, and how this influenced the performance of the chosen technologies, for example by inefficient, but more short-term rewarding, behaviour. A reaction strategy would be installing a monitor displaying information on aggregate future benefits from ventilating efficiently, or about what others do (DellaValle et al., 2018).

ADRIANO BISELLO, SENIOR RESEARCHER, INSTITUTE FOR RENEWABLE ENERGY EURAC

Like other collaborative group discussions, the World Café method wants to create a communicative space for sharing and developing collective knowledge, but the World Café method is less formal as the usual focus group discussion. People like to discuss with some food or having a drink in the hand, the atmosphere is good, the results more spontaneous. In the focus group, each participant tends to represent the institution, more than his/her personal point of view, in this way some "ideas" may not be expressed in the focus group. To assess group knowledge and group thinking about complex topics, as the co-benefits of smart city plans, it is vital to create an atmosphere of trust, purpose and open discussions.

WHY? The **buy-in of stakeholders, as owners and users of the built environment, is essential** for the successful preparation and implementation of any smart city or low energy district plan. They must approve, co-design, and frequently co-realise the plan, and will feel the impact of the proposed changes.

Regarding awareness and motivation of stakeholders, the decision of whether or not to invest in smarter solutions and plans for low energy districts, is driven by many factors besides economic reasons. **More factors are in play, other than simply cost reduction**. Energy efficiency is often a minor factor, with a "low priority, simply because households (even the environmentally aware ones) are much more attracted to other attributes of the products (be it dwellings or vehicles), such as thermal, visual and acoustic comfort, aesthetics, health and safety " (City-zen, 2016b; HERON 2016a). In interviews of homebuyers, none of the owners had considered energy use in their purchasing decisions, while those customers that had installed efficiency measures stated that both thermal comfort and aesthetics were important drivers in addition to reduced costs (EASEE 2012; Tuominen et al., 2011). "Energy is regarded more as a public service than a valuable resource, which is difficult to change unless this implies a tangible improvement in the standard living " (BEEM-UP, 2014).

Motivation is also fed by the source of information - and the trust involved: "Even the best advice of the most competent professional will not be accepted, if it is not corroborated by the opinions and experiences of relatives, friends, [or] colleagues" (HERON, 2016a).

The **abstractness of concepts such as sustainability and energy efficiency**, may also hinder awareness and motivation for such plans. Research by Mörn et al. (2016) found that the engagement of residential tenants and their interest in visualised individual energy data for their households, depended upon how much information was presented and if this was easily understandable: "It could, for example, be difficult for many people to relate to individual kWh figures to understand the impact of their energy behaviour. Possibly, a larger focus on which effect the energy savings have on consecutive fossil fuel savings, or that certain savings correspond to 10 avoided hot showers or one avoided 10-mile car drive, could alter the tenants' energy behaviour more".

Lastly, stakeholders often have to co-finance specific investments**. Lack of awareness or motivation might preclude private investments** in solutions for smart cities and low energy districts, especially when proposed solutions are insufficiently aligned with their respective interests. Including co-benefits in the plan, plays a central role in overcoming this barrier.

TO DO 4: VISUALISE LOCAL CHALLENGES AND POTENTIAL IMPACT

of prospective methods and technologies in neighbourhoods

After consultation with the stakeholders, the next TO DO is to include more spatial details in the envisaged actions in terms of neighbourhoods or building blocks, by making a geographical refinement of the specific challenges identified in the **VISION** stage. What is more, the potential impact of actions must be shown with the help of dashboards, urban platforms etc. These tools, for example based on Building Information Models (BIM) or Geographical Information Systems (GIS), can **visualise specific local challenges and the potential impact at neighbourhood level**. Information about the impact of contemplated solutions, might influence the choices to be made in the next TO DO. ICT tools showing the state of the current built environment with its energy and transport infrastructures, and analysing the suitability of various smart city solutions for specific areas, can help to develop a "common operational picture" and prepare for collective agreement later.

EXAMPLE: COLOUREE

The Colouree platform is an example of software as a service, supporting the real estate market by making use of enhanced geo-referred data and urban spatial analysis with the aim of providing a deep understanding about locations and neighbourhoods. It allows its users to easily match their needs in term of lifestyle, business or commute, with the right location and surroundings. It enables to select the properties and places of interest directly on a web-based map; to discover the most highly rated properties and locations for end users needs and interests; to compare buildings taking into account various indicators and to obtain the real-time results of the analysis of almost one million measurements and geo-referred data in about three minutes. This tool has been successfully used in the Milan Metropolitan area within the European Natural based solutions project Nature4cities by contributing in defining a system of integrated multi-scale and multi-thematic performance indicators for the assessment of urban challenges and nature-based solutions (Nature4Cities, 2019).

WHY?

The aims of this TO DO are to gain an **in-depth understanding of the local situation, and to create critical mass** regarding contemplated solutions. These BIM/GIS based analyses provide insight into what to do where.

JAROSLAV KACER, CHAIRMAN OF COMMISSION OF BRNO CITY COUNCIL FOR OPEN AND SMART CITY – FORMER DEPUTY MAYOR CITY OF BRNO

„To expect, that new smart devices or technologies make a city „smart" is unwise. The important part is to put your innovation into the local context and modularly build your city. Try to imagine your smart city as a cyber-physical building set, that can be expanded or adapted based on current needs."

TO DO 5: DRAFT A LIST OF RELEVANT ON-GOING AND POSSIBLE NEW PROJECTS

with stakeholders

With more information what can be done where, the next TO DO is to create a comprehensive list of **relevant on-going and possible new projects** in transport, energy efficiency and RES, infrastructures and ICT, for instance, as included in the Sustainable Energy and Climate Actions Plans developed under the Covenant of Mayors for Climate & Energy. This is done together with the stakeholders. Plans are becoming rather concrete at this stage.

EXAMPLE: USING PROVIDERS' EXPERIENCES FOR SHAPING INNOVATIVE SOLUTIONS BY PROCUREMENT

Cities can be driving forces behind innovations but being up to date in all current technologies can be a very big challenge. With a new innovative procurement method, it becomes possible for cities to benefit from extensive experiences providers in highly innovative areas already have. At the same time the providers get the chance for new business opportunities as well as the chance to test their innovative ideas under real-life conditions. This can be a big asset for them in the further development of their products. A classic win-win situation.

In connection with fitting smart functionality into lamp posts for Smarter Together, the City of Munich has been experimenting with an individually designed project-specific procurement instrument called "open calls" since autumn 2017. For the implementation a close cooperation with local regulatory and procurement experts is crucial. Rather than asking for specific functions, open calls inspire innovation on the part of providers. They are challenged to develop solutions taking into account the requested services on the one hand while also contributing ideas of their own.

The reason behind this new approach is the fact that there is need for relevant end-to-end solutions. This new type of procurement allows Smarter Together and thus the City of Munich to benefit from the extensive experience of the providers in highly innovative areas in return for a minimal investment risk. The open calls were addressed to start-ups, researchers and developers, but also established corporate players.

The first open call for the lamp post sensors was concerning weather data and air quality. The cooperation with the chosen providers started in spring 2018. The second open call was about traffic counting and parking space detection. The implementation of the solutions started in early 2019.

In both cases the ideas brought forward by the providers were a valuable contribution to the Smarter Together project. The lamp post solutions have been implemented together with established technology companies as well as local start-ups (City of Munich, 2019).

WHY? When planning new roadmaps with targets, consistent with the strategies set in place in the **DECIDE & COMMIT** stage, collecting on going or already planned projects is key for optimising the resources and selecting the most appropriate options. Indeed, the integrated approach – or cross sectorial approach – needs a complete overview of on-going/planned projects, in order to make the right decisions. Especially keeping a **permanent holistic view on the different projects in different sectors**, will contribute to an optimised alignment of the timelines, that will lead to saving time, money and resources, as well as ensuring the appropriate design/characteristics of future equipment/systems.

A few typical examples:

- Developing new roads/streets and integrating other equipment when digging the ground (i.e. installing fiber optics, water supply pipes, district heating grid, gas distribution, electricity supply);
- Implementing a district heating/cooling grid and anticipating future retrofit of existing buildings (improving energy efficiency) and/or extension of the built zones, and/or installing solar thermal equipment on all buildings for hot water supply for instance, that will impact on the design and operational characteristics of the district heating equipment;
- Developing pedestrian zones and bicycle lanes in the city centre, anticipating future mobility schemes (i.e. tramways, no traffic in city center, new shared/green squares).

TO DO 6: ELABORATE COSTS AND RISK MITIGATION, CHOOSE FINANCIAL SCHEMES AND SOURCES

by financial readiness checks and financial model(s)

In the **DECIDE & COMMIT** stage, exploration of the possibilities and conditions of different financial schemes have already taken place. Now, this TO DO focuses on **making final choices for the financial models during implementation of the plan**. Different groups of activities are part of this.

Firstly, a detailed elaboration of costs and yields needs to be created for the projects on the list resulting from the previous TO DO. This means calculating key financial parameters such as capital expenditures (CAPEX), operational expenditures (OPEX), return on investment (ROI), profitability etc.

Many solutions for smart cities and low energy districts, have high initial costs and a questionable profitability. Cities' and investors' initial perception is of prohibitively high costs, whether upfront costs, initial costs, or overall costs, are a common issue facing projects at different stages of development and implementation. Factors affecting this perception include the methodologies for determining return on investment (ROI), including internal and external rate of return, as well as assumptions about interest and discount rates. Different ways to deal with high costs are:

- *Public-private partnerships* (PPP's) can often help overcome other challenges facing smart city projects, including lack of initial funding, lack of staff capacity, lack of technical capacity to develop and manage innovative projects. The PPP may transfer to the private sector a large share of the responsibility for developing, managing, and completing the project. But the private sector may only be willing to engage in a PPP if the "partnership structure assures a competitive rate of return compared with the financial rate of return they could get from alternative projects of comparable risk" (Stacey et al., 2016c);
- *Bundling highly profitable project investments with less profitable or unprofitable elements* can be a method for expanding the project while retaining profitability;
- *Mixed financing from various sources and types of investors*, and innovative business models where operational cost savings finance higher investments, or a longer time horizon for return on investment is accepted because of other advantages;
- *Revolving funds, green bonds, crowd funding, pre-financing and subsidies;*
- *Sustainable procurement* including environmental externalities. By monetarising environmental disadvantages of fossil energy use, sustainable projects are higher valued.

However, also citizen stakeholders may have a perception of prohibitively high investment costs and prohibitively long payback times as a common issue facing projects where citizens co-finance the investments. This is often related to their socio-economic status and access to capital, motivation, problems organizing collective agreement and action, and lack of awareness of financing opportunities. Apart from **stressing the direct co-benefits of the plan** (Ferreira et al., 2015), the timing of investments can also provide an opportunity for less costly investments with shorter payback times. For instance, timing the integration of smarter technologies to replace an existing intervention (e.g. substituting PV roof tiles instead of normal planned roof replacement) to reduce additional costs can help alleviate some of the financial burden (R2CITIES, 2014). Usually, the "price" and the "location" are the most important criteria in the choice of a residential property when renting or buying, while the energy efficiency of the building and the energy costs, are considered of minor importance. Real Estate Agents tend to underestimate the role of energy efficiency as a factor in the total price, and attribute the higher value of a new property entirely to its newness. Possibly, this is the result of their extensive experience with trading existing properties, which have usually poorer energy efficiency. However, more and more studies at European level depict an emerging market for high-energy performance buildings, gaining a price premium, ceteris paribus, near 5 to 10% compared to low class rated properties, although this differs between the rental and selling market (Pascuas et al., 2017).

Secondly, this information is used to **assess the suitability of possible financial schemes**. This entails also a proposal for sources of finance and funding. A wide range of possibilities from within financial and funding schemes exists, see section 2.3. A financial readiness check can be instrumental to prepare requests for funding (see 3.3 Inspiration). Split incentives are a commonly encountered issue in smart city and low energy district projects, which is partly related to sources of finance (see Bird et al., 2012). It means that the actors financing the project, often a real estate developer or building owner, and the actors benefiting from the project, usually the tenants, are different. For these reasons, a fair division of costs and benefits must be part of the plan. It can be achieved by users contributing

to the costs of the investment, ESCO's, mixed financing business cases, sharing of profits according to investment, or energy-neutral rents (consisting of rent and energy costs together, where energy savings finance the refurbishment of the buildings).

Lastly, finance and funding organisations will ask for more information about the **real and perceived risks associated with the projects on the list**. Generally speaking, conventional solutions are often preferred by stakeholders in order to avoid unknown problems with innovative solutions, such as flaws in construction work or inadequate maintenance (HERON, 2016a). New or innovative solutions are considered to carry with them a higher implicit risk, and this leads to apprehension from many stakeholders, including public entities, private enterprise, the public, and financial lenders. Small-scale projects can provide a low-risk way for public entities to support test-beds for innovation; raise familiarity and skill levels by involving local partners in the project; reduce apprehension by verifying and validating the project claims; and alleviate unfamiliarity through public exposure and participation. Other ways to deal with innovative solutions perceived as too risky, are organising a better exchange of knowledge, and a a better integration of technological and financial economic knowledge e.g. investors and solutions providers. Ideally, possible risks should be roughly identified before negotiations with the preferred sources of finance and funding can start. Risk mitigation, contingency planning, and guarantees on performance of smart city and low energy district solutions help to make the envisaged solutions less risky.

In the end, this TO DO results in a choice for a financial model, i.e. a revolving fund, loan, grant, or mixed financing, and a (sub)plan for mitigating risks.

EXAMPLE: MIXING HIGHLY PROFITABLE WITH LESS PROFITABLE INVESTMENTS

"...building pools - can provide a good solution for the management of property energy issues. The technique involves combining several buildings into a single joint project. This allows elements with lower energy saving potential to be included with others having higher energy saving potential. These pooled buildings have different levels of energy consumption, different construction materials, different fixtures and fittings etc., which leads to profitable cross calculations and also means that seemingly unprofitable buildings can be integrated into the project" (CITYnvest, 2017).

EXAMPLE: PILOTS TAKE AWAY PERCEPTION OF INNOVATIVE SOLUTIONS AS TOO RISKY

"... in a big organisation like our city ... change is difficult. It is difficult to say "let's do it in this way instead of how we've always done it" - that is difficult to implement. But if you do pilots, and you try something instead, and everyone sees that it works out well, then it is very inspiring for others to just start following. So pilots are important for inducing change in a big organisation...there are no big dangers since they are still rather small, but once they have been implemented, they are like lighthouses and lead the way" (Interviewee #6, 2017).

WHY? Projects focusing on issues such as building refurbishment for higher energy efficiency, are often not considered as **sufficiently economically attractive for investors**. One of the causes for this is the fact that the social and environmental costs of energy use are not included in the price. This reduces the value of saved energy, while increasing the relative price of renewables compared to conventional sources (R2CITIES, 2014), making it difficult to classify energy-saving measures within the standard financial models and valuation procedures used in finance (City-zen, 2016).

Energy saving aspirations may provide net benefits to the city or the community, but will likely add costs that are difficult to finance through conventional mechanisms that do **not value non-monetary benefits** (Stacey et al., 2016a). In short, "the payback period for companies is too long and the risk too high" (Rivada et al., 2016). For citizens, this payback time may not be an issue from a true economic viewpoint - if the net present value over the lifetime of the investment exceeds the investment cost – but the lifetime of the investment may exceed the expected occupancy time of the homeowner. In this case the homeowner may move before their investment is recovered, and the selling price may not be expected to properly reflect the investment (EFFESUS, 2017). There may also be a perceived (or actual) negative effect on the value of a property due to project intervention (Di Nucci et al., 2010). This can include value or appraisal based on architectural features, such as the covering of external brick features due to the application of external insulation (and then stucco, paint, or another "lower value" covering).

Regarding **split incentives**, they reduce the attractiveness for the Real Estate Developer or landlord of a prospective investment in a project or smart, energy-efficient solutions which do not provide many financial benefits (HERON, 2016b; City-zen, 2016; Rivada et al. 2016). Legislative frameworks play a role as well in this: In some cases the building owner is not allowed to reflect the investment in the rental price, and thus has no way to recoup the investment. In other cases, bilateral contracts can "easily arrange the transfer of money, [but] they do not solve the transfer of risks" (City-zen, 2016a).

New or innovative solutions are generally unproven and unfamiliar, and often considered to incorporate **more implicit risk**. This risk can manifest itself in apprehension from public entities to support innovative projects, hesitation from private enterprises to get involved in projects where they lack experience, unwillingness for public consumers (end-users) to support unproven projects, and increased costs (or outright refusal) for funders to back innovative projects. Innovative processes are inherently unproven and generally do involve increased risk of failure; especially compared to the existing approach or business as usual.

Public entities have several concerns, including making a bad decision with public money, and lack of insight into costs and benefits, not having sufficient experience combined with risk-aversion, uncertainty on risks emerging after project conclusion, which may trigger a loss of confidence and backlash against innovative projects (Rivada et al., 2016; EASEE, 2012). Private enterprise, including private partners in PPP, cite the public lack of demand and lack of internal awareness (esp. among architects and engineers) of innovative solutions (Rivada et al., 2016; EASEE, 2012). With respect to public consumers, the public may be reluctant to adopt, convert to, or invest in more innovative solutions due to scepticism, unfamiliarity, expectations of unpredictability, and concern over the reliability of new technologies (HERON 2016a; MEnS, 2015; BEEM-UP, 2014). They may also lack willingness to try new things, or be comfortable in their routines and unwilling to behave differently or have to learn new skills. Regarding financial lenders: With the increased risks come increasing costs, and an increasing difficulty to secure funding. Much of this is due to the larger uncertainty inherent to the approach, leading to difficulty in properly characterising the financial situation within an acceptable range of certainty. Banks may be unwilling to finance innovative projects due to lack of knowledge and lack of experience" (Rivada et al., 2016; EASEE, 2012; BEEM-UP, 2014).

TO DO 7: RANK AND SHORT-LIST PROJECTS

according to their viability and select the best projects

Now the financial for the envisaged projects is clear, the next TO DO is to reach agreement with the key stakeholders about **which projects should be short-listed**. In meetings and workshops with stakeholders, proposed projects on the list drafted for TO DO 5 have to be ranked according to their viability. Comparable to the **DECIDE & COMMIT** stage, where "routes" to solve the problems where prioritised, this is done by taking into account factors such as:

- Maturity of the proposed project;
- Financial feasibility;
- Risks (not only financial, also other ones);
- Potential impact;
- Consistency with targets in general, overall city plan or vision.

After the ranking, the most viable projects must be selected. Usually, a couple of iterations is needed to come to an agreement about which proposed projects should be selected. Co-design of the content of plans with other stakeholders, often in a couple of iterations, contributes to establishing the basis for collective agreement.

EXAMPLE: COLLABORATION ON SMART CITIES IN THE QUADRUPLE HELIX

Fomento San Sebastian is leading the transition of the Txomin neighbourhood in the Urumea Riverside District to a smart district, branding on sustainability. San Sebastian started planning the process in the FP7 STEEP project with the definition of strategic projects and the involvement of the smart ecosystem of the city. The Smart Plan for the city was designed, in which an integral plan for the city's smart strategy was established with the main challenge of establishing a strategic line with shared objectives and to give coherence and co-ordination to the public action. Fomento San Sebastian works on a smart clustering policy that involves the stakeholders of the smart environment of the city in the different actions and projects developed. REPLICATE project funded by the H2020 programme and coordinated by Fomento San Sebastian has deployed implementations in energy efficiency, sustainable mobility and ICT/Infrastructures in the city (Fomento San Sebastian, 2015 and 2019).

The Txomin residential neighbourhood has the Urumea river that crosses the district, acting as the main axis of the area but also representing a barrier, as well as being the cause of the area's flooding problems. This area was urbanised during the first half of the 20th century, with low energy efficiency buildings, connection problems etc. To address this problem, the City Council defined different plans that, together with the smart projects that are under way, are making possible the transition to a smart district. In the REPLICATE project framework 156 homes and 34 commercial premises are being retrofitted, the District heating system will give service to the 1.500 new homes and the 156 retrofitted properties. A demand management platform is being

developed which will enable users discover their energy consumption in real time. Actions implemented in sustainable mobility include electric buses for the connection with the city centre and electric vehicles (e-cars and e-mopeds) as well as a Smart Mobility Platform. In the field of ICTs, the city's high-speed mobile wireless network, smart public lighting and the Smart City Platform have been developed. This platform enables part of this information to be published in Open Data and additionally allows for a Citizen Participation platform that has been launched.

REPLICATE and other complementary smart city projects led by Fomento San Sebastian are fostering the transformation of the Txomin neighborhood that will allow validation of different solutions for their replication in other districts and cities around Europe.

EXAMPLE: PRIORITISING ACTIONS FOR A SECAP

The Joint Research Centre published a guidebook which explains how to put in place and implement a Sustainable Energy and Climate Action Plan (SECAP) (JRC, 2018).

A baseline review is the starting point for the SECAP process from which it is possible to move to relevant objective-setting, elaboration of adequate Action Plan and monitoring. The baseline review needs to be based on existing data. It should map relevant legislations, existing policies, plans, instruments and all departments/stakeholders involved. Completing a baseline review requires adequate resources, in order to allow the data sets to be collated and reviewed. This assessment allows elaborating a SECAP that is suited to address locally important issues and specific needs of the local authority's current situation. The aspects to be covered can be either quantitative (development of energy consumption...) or qualitative (energy management, implementation of measures, awareness...). The baseline review allows prioritising actions and then to monitor the effects based on relevant indicators.

The main questions that guide the process are the following: What is the energy consumption and CO_2 emissions of the different sectors and actors present in the territory of the local authority and what are the trends? Who produces energy and how much? Which are the most important sources of energy? What are the drivers that influence energy consumption? What are the impacts associated with energy consumption in the city (air pollution, traffic congestion ...)? What efforts have already been made in terms of energy management and what results have they produced? Which barriers need to be removed? What is the degree of awareness of officials, citizens and other stakeholders in terms of energy conservation and climate protection?

After the baseline data collection and the CO_2 baseline emission inventory compilation, a list of projects within the public administration on energy infrastructures, municipal fleet, buildings, energy consumption and energy management, transport and mobility must be identified. In addition, the potential projects where the private sector and industry can contribute to achieving the common objectives should be charted. The prioritisation of projects to implement depends on the expected impact that the project has in term of CO_2 reduction, the financial resources available both from the public and private sector and the maturity and expected feasibility of the projects.

WHY?

A choice must be made from projects which are the most viable, and at the same time, will have the highest impact, in order to achieve the objectives as stated in the **VISION** stage.

TO DO 8: ENSURE APPROVAL AND COMMITMENT

for selected projects by city administration and stakeholders

After the best and most satisfactory project proposals have been selected, this choice must be approved by the politicians in the city administration, while **key stakeholders should support this selection as well**. They must approve the proposed projects and commit themselves to their realisation in future. This buy-in of the city administration and the key stakeholders, helps to secure budgets and human resources for realisation later.

As mentioned earlier, in the field of smart cities and low energy districts, a common situation is fragmentation among a large number of different actors and a "lack of co-ordination/co-operation between multiple stakeholders and their interests" (Rivada et al., 2016). This situation is most commonly encountered in projects that involve renovation or retrofitting of multi-ownership buildings. In many countries, property owners within residential multiple ownership properties commonly (or are legally required to) establish an owners' association, condominium agreement, or housing cooperative to manage common building maintenance and utilities (EFFESUS, 2017; LEAF 2016). As part of these systems, owners generally make monthly or annual payments into a communal fund (and have a collective debt), to pay the costs of regular building maintenance, and cover unforeseen or future repairs. Existing management and funding systems also provide a vehicle for the organisation of collective action and for collective investments in smart city projects, such as energy efficiency and performance improvements. In the absence of an existing collective agreement, professional property management companies can also fill the gap and "be used as an organisational and financial vehicle for energy-related retrofits in the absence of building owners' associations" (EFFESUS, 2017).

ETIENNE VIGNALI, PROJECT MANAGER LYON CONFLUENCE

Thanks to the Smarter Together project, the Lyon-Confluence urban project cooperates with a broad range of (public and private) stakeholders, to make progress on energy challenges faced by urban areas.

Organising collective agreements among the distributed owners and different actors in multi-owner buildings adds an additional layer of complexity to an already comprehensive process, owing to the diversity and divergent interests of the stakeholders (EASEE, 2012; EFFESUS, 2017). This

challenge is often intertwined with the split-incentives issue, as "...owners are rarely a homogeneous group, but a mix of owner-occupiers and short- and long-lease landlords, and of different age groups and household forms" with "often different and opposing interests on how to develop their properties" (EFFESUS, 2017).

WHY? This TO DO is clearly related to the third TO DO at this stage ("Reconnect to stakeholders"). For most smart city and low energy district projects, the city administration is in a central position. Therefore leadership and political approval go hand in hand, and are crucial for a successful start and the realisation of the project. Besides, the **buy-in of key stakeholders is needed**: the proposed projects alter their living environments, and from a legal perspective, their approval could be even mandatory. What is more, stakeholders might have to bear a part of or the entire the financial burden. For all these reasons, stakeholders should be explicitly asked for approval, support and commitment, next to the city's administration.

TO DO 9: PREPARE THE MONITORING PROCESS

by considering KPI's for targets and co-benefits

Now the most viable project proposals have been selected, preparation of the monitoring process can start. Usually this happens at interdepartmental city level with the help of sectorial experts.

Monitoring is a necessary step for action plan and project management and permanent improvement. In the case of smart and sustainable cities and communities' projects with a holistic approach, monitoring helps in achieving a consistent and systematic evaluation process:

- It clarifies programme objectives;
- It links activities and their resources to objectives;
- It translates objectives into performance indicators and sets values for targets;
- It routinely collects data on these indicators;
- It compares actual results with targets;
- It reports progress to managers, authorities and citizen;
- It alerts them to problems.

Translating objectives into performance requires an appropriate set of indicators, known as KPIs. These KPIs are characteristic indexes to be measured. They can vary enormously: from number of people using public transportation, temperature in buildings, number of public consultations, number of green areas and total surface, number of KWh produced by renewables, annual weight of residual waste per inhabitant, share of the population with internet access, annual GHG emission, number of e-vehicles in self-service, to air quality, noise levels, etc... KPIs can be either quantitative or qualitative.

At this stage, KPIs are considered which reflect progress, not only on the targets as defined early during the **PLAN** stage, but also capture co-benefits other than reduced fossil fuel consumption or less GHG emission: additional benefits, not only for citizens and other stakeholders (e.g. improved public spaces, less energy poverty, less air pollution), but also for the city administration itself (e.g. lower operational expenditures, smoother inter-departmental collaboration).

That the **gathering of data for monitoring of smart city and low energy district projects**, can easily lead to issues in the field of data privacy, was confirmed in interviews conducted for this guide. Smart city and low energy district projects often focus on data as a way to track activities, measure consumption, learn about usage patterns, and optimize solutions, but maintaining the trust of public and private entities with regards to privacy is of paramount importance in order to further these concepts. The project should be transparent about its data collection and use policy. One key player recommends that every dataset includes privacy considerations in its design and implementation. Privacy needn't dominate the discussion or lead the conversation astray, but it should be treated with the respect and importance that it deserves. Another key player stresses that open data should always be aggregated data and under no condition contain private information.

A standardized approach to data privacy could help resolve some of the apprehension and resistance to sharing information, but this "would need to be quite complex, since privacy within a dataset can be compromised by comparing data from other datasets", according to an interviewed key player. Other possibilities are application of technical measures as encrypting and improved security of for instance smart meters. During hackatons security of planned or deployed technology can be tested, and subsequently improved.

EXAMPLE: SMART PLATFORM FOR MONITORING

SmartKalea is an innovative initiative of Fomento San Sebastián that establishes a public-private collaboration model that integrates all agents that co-exist in a city environment from a Smart perspective: citizenship, businesses, technological local companies and Municipal Departments, lead by Fomento San Sebastián. It consists of a pilot project based on Smart implementations to test and validate a comprehensive model, for its expansion to other geographical areas and turn Donostia in a Smart City reference.

More specifically, SmartKalea promotes environmental sustainability, energy efficiency, citizen participation and transparency using state-of- the-art technology from local technological partners, integrating data into the project's smart platform for monitoring and obtaining indicators that promote the improvement of the management of the city. The SmartKalea project was launched in 2014 in Mayor Street, an iconic street of the Old Town of San Sebastian. The good results of this first pilot have allowed the continuation of implementations and the replication it in other areas of the city. In 2016 the project was expanded to the whole of the Old Town and was replicated in the Altza neighbourhood. Funding from the Regional Government (Diputación Foral Guipúzcoa) was received for the replication in the Altza neighbourhood. SmartKalea will continue implementing smart solutions in different streets and neighbour of the city such as Sancho El Sabio in the Amara neighbourhood (Fomento San Sebastian, 2019).

EXAMPLE: TRANSPARENCY OF OPEN-SOURCE DATA

Boulder, Colorado's IT department conducted a thorough "review of data schema and record refresh plans before publishing their open data website. This included developing licensing terms including terms of use, attribution and a disclaimer" (Bent et al., 2017). The city is a founding member of OpenColorado, a collaborative project with other local governments sharing transparency strategies and providing open-source data and public information (OpenColorado, 2017; Bent et al., 2017).

EXAMPLE

Glasgow, Scotland's Open Glasgow programme, embedded a "new culture of 'Open by Default' within Glasgow" where the City Data Hub addresses "concerns about privacy and data quality and maintenance ... by providing a configurable workflow that includes validation checks, and automated publication from business systems" (FCG, 2017). "'Improved transparency, communication and collaboration by opening up data are significant factors in the smart city journey; one that Glasgow has undertaken and one that cities around the globe are pursuing' Pippa Gardner, Programme Manager, OPEN Glasgow" (FCG, 2015).

WHY? Access to data is one of the core principles of many smart city projects. Interviews with key players confirmed that **collecting and processing data, promoting collaboration, and providing access to that data, while maintaining privacy, have become a common issue in smart city and low energy district projects**. Some projects have found that not only are regulations concerning "data usage, protection, gathering and re-use of public sector information" inadequate, but existing regulations suffer from issues of noncompliance (Interviewee #1, 2017; Interviewee #2, 2017; Stacey et al., 2016a). Main concerns regarding data privacy shared by the interviewees are as follows:

"Maintaining privacy of data while promoting interoperability is an issue" as are: "Property rights and privacy regarding prototypes" "Protecting the data itself" and "Gathering enough information, while remaining with the law regarding the profiling of people – which is forbidden by law".

"...every new dataset needs to consider privacy...never-ending but not enormous. It needs to be discussed and resolved with every dataset." "Privacy shouldn't be a showstopper...but it shouldn't dominate the discussion. It can lead the conversation astray" "Give the issue of privacy its proper place...not ignored but a showstopper...don't let the concern get out of hand and hinder progress on the issue".

"...the ones who are really concerned about privacy – including the project promoters and managers...so some of these are internal obstacles that are welcome in a way – you want to put out a good product that doesn't compromise security/privacy".

"Need to maintain trust…accept the concerns of the public/private…Worry about losing the trust of the public".

"Standardisation of approaches to privacy within datasets could resolve some of the resistance or conflict" "…but this would need to be quite complex, since privacy within a dataset can be compromised by comparing data from other datasets".

"on one hand, you want to collect a lot of information to make a smart city…on the other hand you don't want to infringe on people's private information".

TO DO 10: PREPARE IMPLEMENTATION

through own finance and funding, contracting, public procurement and PPPs

The last TO DO for this stage is to start preparing contracts, public procurement, and public-private partnerships. Cities often have in place existing practices for procurement (the public purchase of work, goods or services from companies), but these are often incompatible with innovative solutions. They are based on an existing model of provision, and therefore support the business-as- usual situations better.

One approach to **promote innovative solutions** is to tender calls for solutions instead of specific products or services – in this manner the solution provider is allowed a wide range of options to meet the guidelines of the tender, and may develop new solutions outside the expectations of the tender (Stacey, 2016). Another approach is to include criteria for sustainability as energy efficiency, re-use and clean energy production in public procurement.

EXAMPLE: FROM PROCURING GOODS AND SERVICES TO PROCURING SOLUTIONS

"A move from procuring goods and services to procuring solutions to a challenge. This is one new tender model that seeks to form a relationship and increase collaboration between the customer and suppliers and between suppliers. Using the responses to tenders to refine and add value to the proposed solutions from the private sector is an iterative process that builds capacity in both the customer and the market. It also uses the city as a testbed and demonstrator for new processes and technologies allowing and encouraging further replication and shared learnings across the public sector" (Stacey et al., 2016a).

EXAMPLE: FAST-TRACKING HIGHLY STRATEGIC SUSTAINABILITY INITIATIVES

"[Washington] DC's complicated procurement process can take six to nine months. When funds must be spent within 12 months, sometimes there is not enough time to complete the actual work. Recognizing the delays in contract procurement, the District Department of the Environment created a Green Building Fund Grant Programme for highly innovative projects. The grant allows the city to move more quickly than the traditional procurement process and fast-track highly strategic sustainability initiatives. The grant is currently funding projects to perform quality control for its energy benchmarking programme, create a "smart buildings plan" for the city, drive innovation in the green appraisals market, green real estate listings for residential properties, and develop the DC Smarter Business Challenge – a green business competition platform" (Bent et al., 2017).

EXAMPLE: BUILDING INFORMATION MODELLING BIM AS REQUIREMENT IN PROCUREMENT

The European Public Procurement Directive 2014/24/UE, Art. 22 states: "For public tenders and designing bids the member states may ask the use of specific electronic instruments like electronic simulation instruments for the constructions information or similar instruments" (EC, 2014c).

To quote an example, recently the Italian Ministry of Infrastructure and Transport worked on a draft decree governing the obligation to use Building Information Modelling (BIM) in the design of public works. The new Code of Conduct for public procurement introduced mandatory specific design methods and electronic tools, such as modelling for building and infrastructure, as required by European legislation. This obligation is aimed at rationalizing design activities and related verifications, by improving and streamlining processes that influence contracting. According to the text, the obligation will gradually enter into force: from 1 January 2019 for complex works relating to works of an amount equal to or greater than 100 million euro, on 1 January 2025 for all new works. Electronic modelling - the Ministry explained - is a paradigm shift in the construction sector that will allow rationalization of investment spending, internationalization of professionals and businesses, and will help to make the sector more efficient and transparent. The process, known and already applied as BIM, is a model for optimizing, through its integration with specific electronic methods and instruments, the design, construction and construction of buildings in the infrastructure sectors. Through it all relevant building data that is present at each stage of the process must be available in open and non-proprietary digital formats.

BIM becomes a powerful instrument to increase communication, certainty and transparent information-sharing. It helps to reduce risk, increase productivity and see how the project is evolving and being built. When collaboration is needed between multiple contractors, design teams and owners, BIM is a means to coordinate them and track the project reducing of 50% the project risk management.

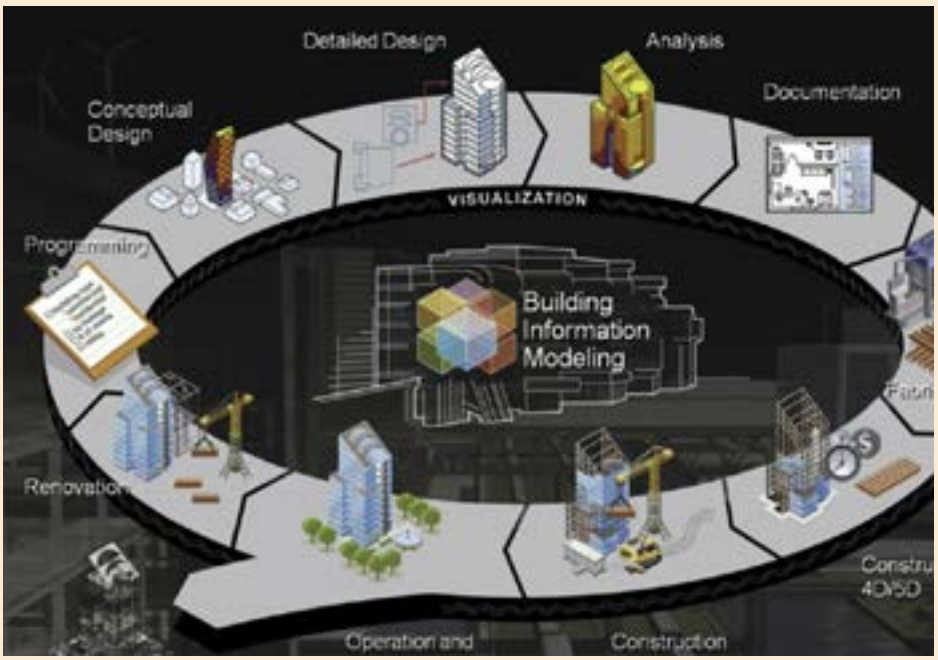


Figure 3-3 BIM – Collaboration among stakeholders and across phases is the key word. Source: Cutler (2016)

There are many variations of procurement methods that depend on the client, their scale, sector, stage of maturity and attitude to risk. Using BIM there is an opportunity to improve information management assistance in public procurement processes, BIM can be used in collaboration at all design, construction and operation phases. This assistance can begin with the creation of a shared data environment, so that model-based sharing of information could be included in the collaborative BIM procurement process (Bolpagni, 2013).

EXAMPLE: PUBLIC SECTOR COMPARATOR

In Public Administration, the **Public Sector Comparator (PSC)** is a tool used by public administration in determining the proper service provider for a public sector project. It consists of an estimate of the cost that the government would pay were it to deliver a service by itself. The World Bank has its own definition, wherein a PSC "is used by a government to make decisions by testing whether a private investment proposal offers value for money in comparison with the most efficient form of public procurement."[1] Generally, the PSC allows governments to figure out if a public–private partnership or other arrangement would be more cost effective.[2] The PSC is most commonly used in UK. The city of Genova has recently obtained an ELENA project using PSC.

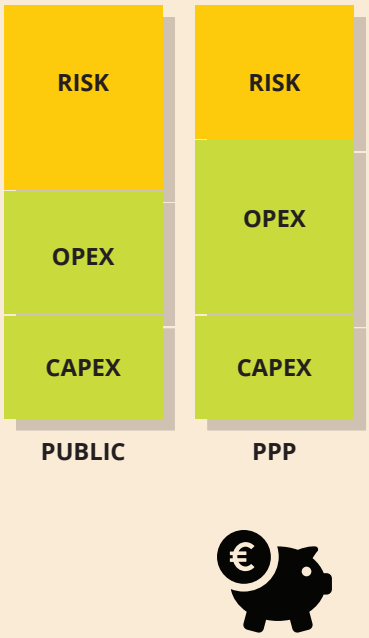


Figure 3-4 Public Sector Comparator.

WHY? Public procurement processes are seen by many projects as being a cumbersome and complex procedure that involves too many stakeholders and intimidates project developers (CITYnvest, 2017; Rivada et al., 2016). **Existing procurement models discourage innovation in both products and services by having a rigid model of providing for the specifications required** (Stacey, 2016). Municipalities have little experience with alternative approaches, such as Public Procurement of Innovation Solutions (PPI) and Pre-Commercial Procurement (PCP), and therefore are unaware of the potential benefits (Rivada et al., 2016). "Public bid procedures can be very time consuming" (Interviewee #1, 2017). Regarding procurement – there is not really a specific actor tied to the obstacles, but more a problem of untangling the complexity (it's too difficult) (Interviewee #2, 2017).

3.4 Inspiration

Urban platforms

According to the EIP-SCC initiative Urban Platforms, an Urban Platform is a way to disclose a logical data architecture of the city that connects and integrates data streams within and across city systems, in a way that uses modern technologies (sensors, cloud services, mobile devices, analysis, social media etc.). An Urban Platform helps in implementing integrated planning related strategies and roadmaps by providing some basics for cities to quickly move from fragmented to holistic operations, inclusion predictable operations and new ways of involving and serving city stakeholders; It can contribute to

making results tangible and measurable (e.g. increasing energy efficiency, reducing traffic congestion and discarding, developing (digital) innovation ecosystems, effectively managing city activities for administrations and services), by providing the necessary infrastructure for organised and robust collection of data.

The proposed Urban Platform is an open shared architecture that is used to collect, manage and share city data, which are stored in the cloud. Figure 3.1 shows an overview (EIP-SCC, 2016)

Urban platforms are mostly funded by the city, but sometimes regional and central governments can also be involved. The EIP-SCC designed an urban platform that is fully based on requirements co-produced by the ten involved cities, on an open architecture, and on standardisation frameworks.

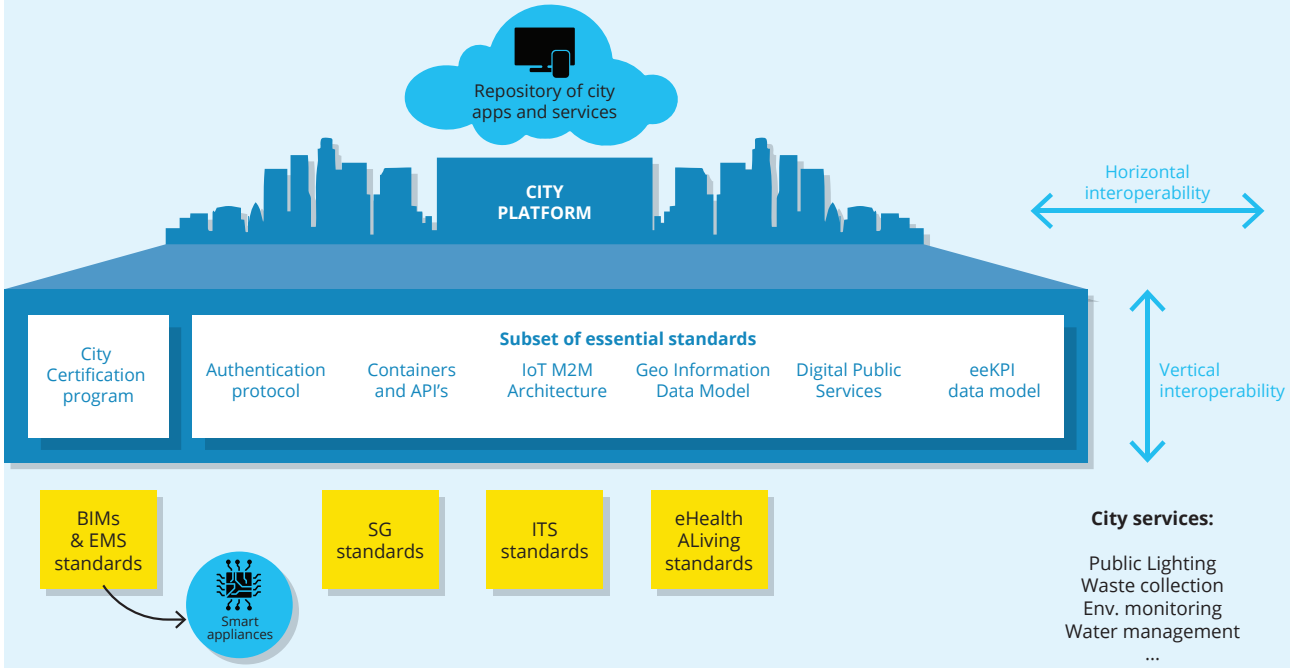


Figure 3-5 High-level review of the urban platform Source: BSI (2017)

The EIP-SCC Urban Platform initiative developed three resources: A Management Framework, Requirements Specification for Urban Platform, and Standards. The Management Framework is a very comprehensive set of practical and organised methods (e.g. templates, tools, value and business cases) which can be used together to identify, redirect and enhance the quality of the cross-domain and integrated city data management methods. Figure 3.2 illustrates the logical path that the city must follow in order to create the framework (BSI, 2016).

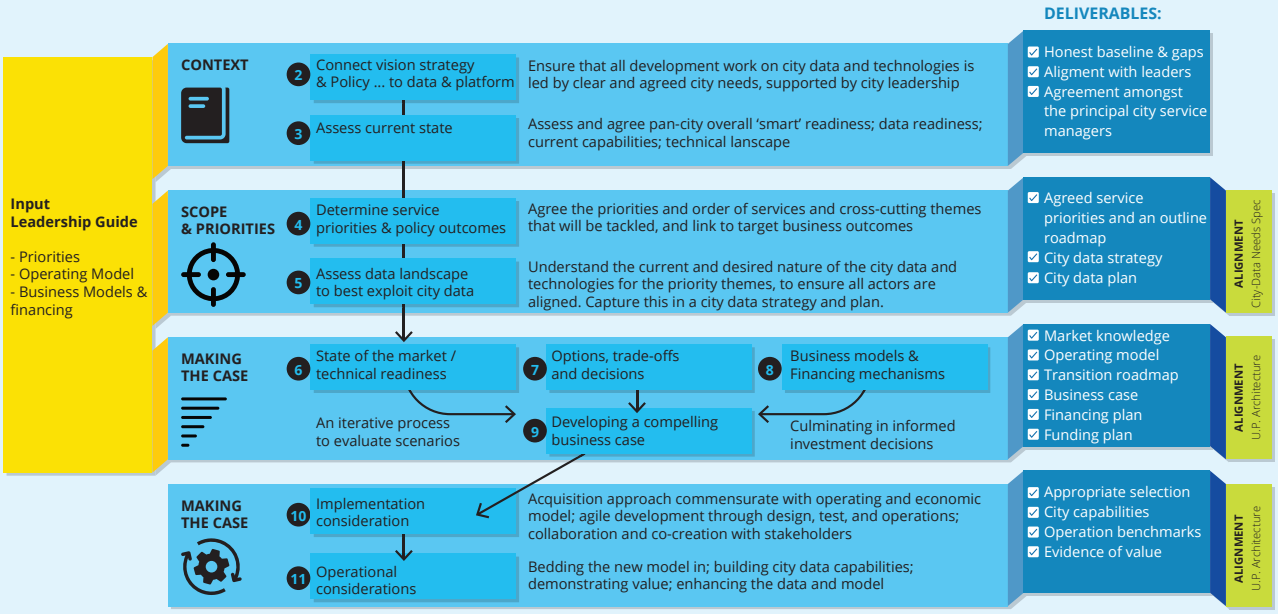


Figure 3-6 Steps to follow in the framework development (Source: BSI 2016, 2017)

The Requirements Specification for Urban Platforms was created by the core group often cities to assist to others in the development of their own platform specifications; the cities - London, Amsterdam, Berlin, Gent, Barcelona, Murcia, Valencia, Derry, Mannheim, Copenhagen, Scottish cities, and Southern Italy. The document identifies an explicit set of technical (e.g. related to standardisation) and non-technical (e.g. policy-related results) requirements (BSI, 2017).

In addition, in consistency with the present Smart City Guidance Package and its related set of steps, ISO TC 268 is developing a standard on Management guidelines of open data for smart cities and communities, in support of/complementary with the implementation of its management system standards ISO 37101 and all related 371xx series of standards.

Citizen engagement

(Maria Sanguiliano - Smart Venice)

This section explains how to successfully involve citizens and other stakeholders, such as local businesses, in the planning and implementation of smart city projects. Many examples demonstrate the best practices in this field.

Participatory Budgeting

Participatory Budgeting (PB) is a form of participatory and inclusive democracy that empowers residents, which engages them in finding solutions responding to their needs and knits communities together. By bringing people together, the latter can learn, debate and deliberate about the allocation of public resources; for this reason, PB is considered to be a form of participatory and inclusive democracy and

as a key element of the next generation of democracy. It began its journey in Porto Alegre, Brazil, back in the '90s. Throughout the years, it has proven to be a powerful enabler allowing citizens to contribute as actors of their own city's administration. Since its launch, European examples of Participatory Budgeting have increased from 55 to over 1.300 with over 8 million citizens actively involved in PB today and 3 thousand cities and municipalities implementing PB.

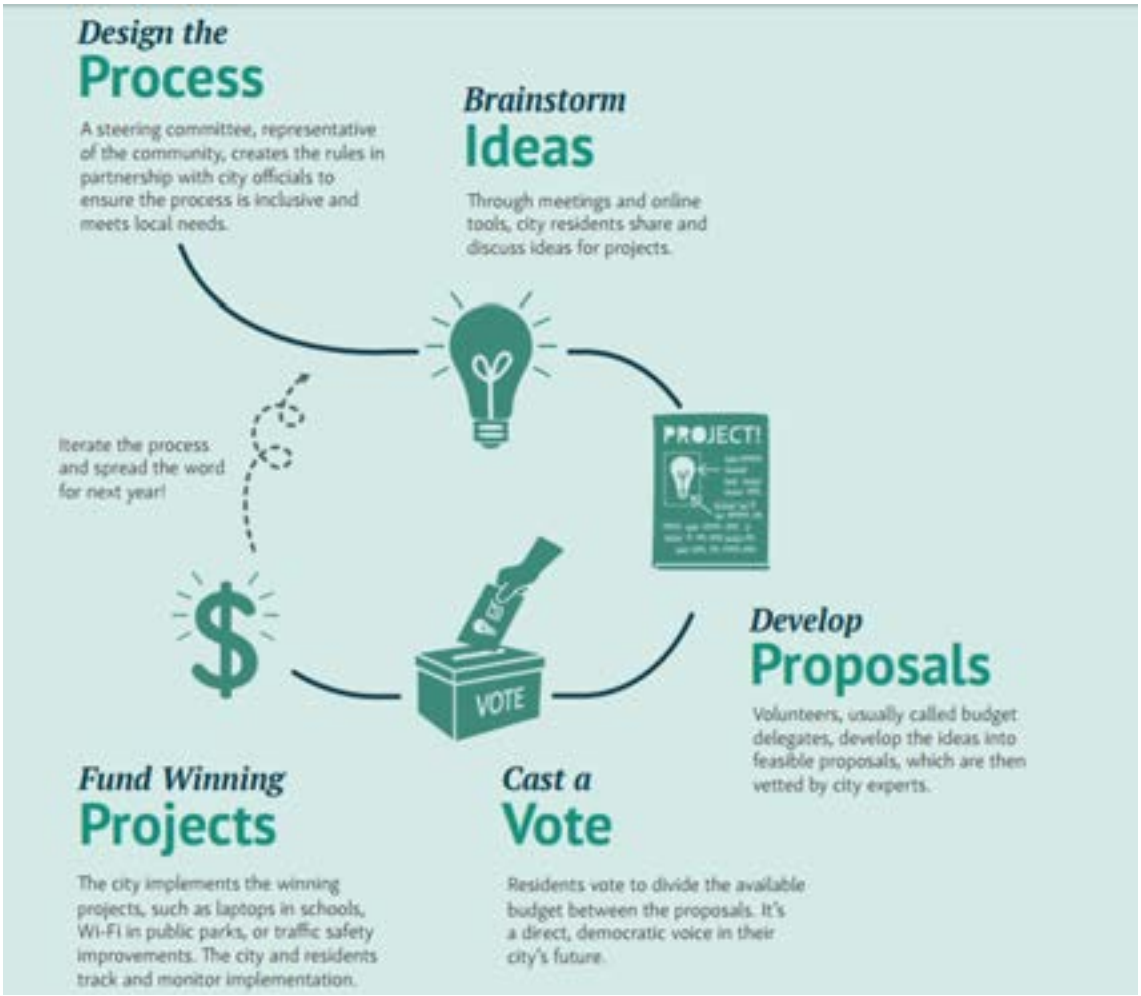


Figure 3-7 How PB works

PB involves an annual cycle of meeting and voting, integrated into the broader budget decision-making process, which follows five steps: 1) Process Design; 2) Idea Brainstorming; 3) Proposal; 4) Voting and 5) Winning projects Funding (Next Generation Democracy, 2016).

Participatory Budgeting procedures are characterised by three specific features:

1. Explicit discussion of public expenditures, followed by the project's entry into deliberation, process where local authorities are engaged
2. Co-decision as a binding element of public decision-making
3. Proposals developed by citizens (or groups), voted and implemented in a continuous loop of feedback loop from and to citizens.

This new practice has demonstrated it motivates broad civic participation, it engages a true cross-section of the community, makes people feel inspired and active, and it supports communities in becoming more resilient and connected.

Participatory Budgeting as an EIP-SCC Marketplace Initiative

Being the focus of the Citizen Focus Action Cluster the civil society, industries and different layers of government working together with citizens to realise public interest at the intersection of ICT, mobility and energy in an urban environment, the cluster gathers three initiatives promoting activities across European cities to ensure the active role of citizens in smartened-up cities.

Given the digitisation of cities and the development and take up of new leadership methods across cities, the action cluster has recently launched a dedicated initiative on Participatory Budgeting for Inclusive Smart Cities and Communities to foster knowledge sharing and capacity building across Smart Cities. The initiative, aims at defining scenarios to use PB and pilot cities to define best practices to be replicated on a larger scale. Technology solutions for PB are also of crucial importance for the initiative, which is indeed dedicating several knowledge sharing activities to this topic, and are meant to be included in the dissemination of best practices, after the piloting phase.

Participatory Budgeting in the e-Government plan

Many cities have been increasingly using on-line digital tools to implement PB, either through in-house designed or Open Source or proprietary platforms.

The implementation of a digital Participatory Budgeting process requires a number of core functions for carrying out the standard phases of a PB process. These functions relate to the collection of ideas, technical analysis, selection and monitoring. The majority of these platforms includes a Content Management System for the management of top-down communication regarding the advancement of PB processes.

Platforms are, in a way, a subset of the larger category of collaborative platforms for social innovations developed and diffused during the last years and this provides Participatory Budgeting the opportunity to feed into e-Government plans and actions.

How can we move from planning to implementation? By supporting the delivery of PB processes through ‘standardisation of methods’ activities, putting emphasis on PB within the eGov action plans, creating a knowledge-sharing online platform and conducting research activities to discover new domains in which PB could be implemented.

EMPATIA platform

Organisers and participants in today’s PB processes have started to benefit from a range of ICT enhancements, including those offered by the public sector (e-government tools and open-data policies), and from increased access to online media and social networks. EMPATIA (Enabling Multichannel Participation through ICT Adaptations), a 24 months project, seeks to radically enhance the inclusiveness and impact of PB processes, increasing the participation of citizens by developing and making publicly available an advanced ICT platform for participatory budgeting, which could be adapted to different social and institutional contexts. In so doing, it will support the complete life cycle of budgeting processes in various cultural and political contexts. The underlying expectations of EMPATIA are creating and advocating processes of democratic deliberation and decision-making; contributing to intensify participatory democracy practices in which citizens decide how to allocate part of a municipal budget or other budgets of public interest.

In order to achieve this ambitious goal, EMPATIA will operate on two main lines: producing outputs for facilitating and improving the relation between experimental administrations and their citizens, and providing tools capable of increasing the efficiency of Public Administration offices in their interaction with the participatory decision-making space.

Privacy Management Guidelines & Good practices

Context or privacy in smart cities

The management of privacy will be a major concern in smart cities. First, compliance with GDPR was enforced in May 2018. Secondly, smart city authorities will have to deal with complex ICT ecosystems as shown in the figure below:

- Smart city authorities will have to interact with its citizen on privacy issues
- Smart city authorities will have to deal with stakeholders such as operators, integrators and suppliers. Operators, as data controllers or data processors will have specific privacy obligations such as privacy impact assessment (PIA) or privacy-by-design (PbD)

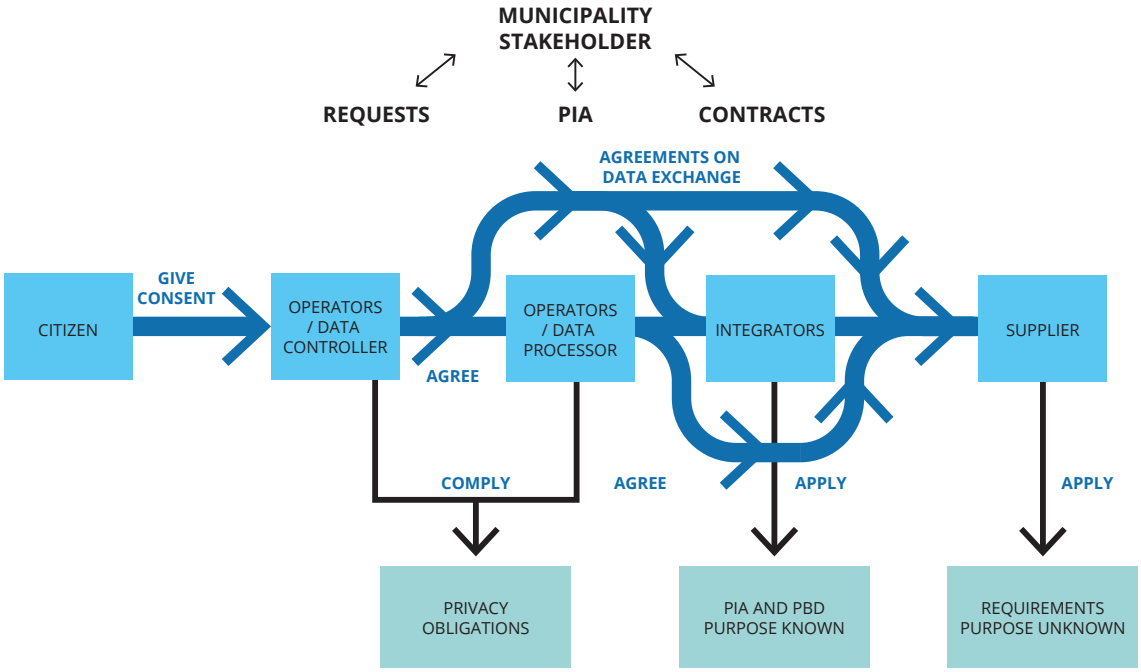


Figure 3-8 How to comply with data privacy regulation guidance

Two recommendations are made:

- Recommendation 1: Engage within the smart city community to share concerns and experience of privacy management
- Recommendation 2: Converge towards common practices concerning privacy management.

The rationale for the recommendations is the following:

- It will create a common body of knowledge
- It will speed up GDPR compliance
- It will contribute to interoperability by allowing cities to exchange, reuse applications with the same level of privacy management practice.

Actions

In order to support the recommendations the *citizen approach to data: privacy-by-design* initiative was set up by EIP-SCC. The following activities have been set up:

- Awareness workshops with the objective of promoting engagement
- Privacy impact assessment workshops with the objectives of sharing practices on privacy management.
- Participation to standardization through the PRIPARE 7001 commitment to EIP-SCC. PRIPARE, initially a support action funded by the European Commission on privacy-by-design, has a liaison category C with ISO/IEC JTC1/SC27/WG5. It has led to the submission of a new standardisation of work within the "privacy in smart cities" sector.

Good practices and tools for citizen engagement

Based on a continued knowledge sharing process with the Citizen Focus Action Cluster, several tools and projects have been identified which are acknowledged as good practices to inspire integrated planning in Smart Cities.

Smarticipate. Opening up the smart city

Funded by H2020 -INSO-1-2015 an enabled open government web platform that allows interested citizens to support the decision making process. Smarticipate is a powerful new tool that addresses these issues and makes co-creation easier for city administrations. Features like a 3D model builder, automated feedback, the possibility to plug in different data sets or share proposals on social media are just some of the elements that can help facilitate cutting edge co-creation processes. The tool is being developed and tested by the City of Rome, the City of Hamburg and the Royal Borough of Kensington and Chelsea, with the support of a consortium of technical experts from across Europe. The Smarticipate platform makes open data available to citizens in an understandable format. By doing so, it has the potential to transform open data from a little used resource to a vital tool to plan the future of a city.

Through the platform, users are able to see proposed urban planning changes on a 3D map of their city. If the user has an idea to improve the proposal, they can make the change directly, observing their alterations in real time. Other users can also see the new proposal and comment on it.

If potential changes violate any legal or policy barriers, the intelligent system will inform the user and gives detailed reasons based on the data provided. In addition to making changes to urban design, citizens will be able to feed in data from their own locality, improving data sets.

WeLive. A new concept of public administration based on citizen co-created mobile urban services

The WeLive project is devised to transform the current e-government approach by facilitating a more open model of design, production and delivery of public services leveraging on the collaboration between public administrations (PAs), citizens and entrepreneurs. WeLive applies the quadruple-helix approach based on the joint collaboration of 3 PAs, 4 research agents and 5 companies, constituting the consortium, plus citizens to deliver next generation personalised user-centric public services. WeLive aims to bridge the gap between innovation and adoption (i.e. take-up) of open government services. For that, it contributes to the WeLive Framework, an ICT infrastructure which adapts, enhances, extends and integrates Open Innovation, Open Data and Open Services components selected from consortium partners' previous projects. An Open Innovation Area is proposed where stakeholders collaborate in the

ideation, creation, funding and deployment of new services. A Visual Composer enables non-ICT users to assemble public service apps from existing blocks. Stakeholders uploaded/sold and downloaded/purchased the generated apps to/from the WeLive Marketplace, thus imposing economic activity around public services. Personalisation and analytics of public services are done through collaboration of the Citizen Data Vault, which manages personal information, with the Decision Engine, which matchmakes user preferences, profile and context against available public services. Two-phase pilots have been conducted in 3 cities (Bilbao, Novi Sad and Trento) and 1 region (Helsinki- Uusimaa) across Europe. Further, the business feasibility and commercial potential of the WeLive Framework, including its individual assets, was validated by developing and deploying sustainable business models.

Smart Cities Lighthouse Projects

The Social dimension has been taken into consideration across SCC-01 projects and several of the collected best practices in demonstration sites in lighthouse cities have shown how citizen engagement has proven to be one of the success factors across several projects and sectoral areas (mobility, retrofitting & energy), while in others difficulties in involving citizens have hindered the full project's potentials to be exploited.
In SCC-01 projects focused on retrofitting, it was demonstrated how the involvement and consultation of tenants was crucial to reach the objectives, like in the REMOURBAN Project pilot in and the SmartEnCity in Tartu (FI) and Sonderborg (DK).

A comprehensive approach to citizen engagement was featuring the SmartEnCity project in Victoria Gasteiz. As part of a citizen engagement plan, "a qualitative research has been developed to map the citizen engagement reality, which is called the Citizen Engagement Strategy Model. The purpose of this model is to create a frame that can be useful for cities that are developing citizen engagement strategies involving the offer of innovative services and products. Additionally, the Communication and Citizen Engagement Committee was created within the governance structure of the Vitoria-Gasteiz's lighthouse project in order to promote and guarantee the community involvement and citizen engagement. The engagement activities in Vitoria Gasteiz include the involvement of the neighbourhood associations; door-to-door invitations to a meeting presenting the project; an exhibition for the residents of the refurbishing typologies, as well as a demonstration of how the connection to the district heating will take place; identification of lead users or early adopters who will be offered some workshops where they can learn from the experiences of other renovation projects, and be given the opportunity to visit the projects. The tenants are being continuously informed about the benefits of the project through the information office opened within the Coronación district, and through specific dissemination actions that take place periodically to strengthen neighbours' engagement. Ad hoc dissemination material has also been created and distributed among the tenants. Another important point related to communication with the stakeholders is that, as a rule, there is a single interlocutor with each community making the communication much easier and more direct, so that each community always talks with the same person to manage all the issues related to the project" (SCIS, 2017).

The Inclusive Manifesto on Citizen Engagement

The EIP-SCC Action Cluster on Citizen Focus has launched on 23 November 2016 in Brussels, during the Conference Inclusive Smart Cities: A European Manifesto on Citizen Engagement, the EIP-SCC Manifesto on Citizen Engagement, an official declaration of the Cluster's commitment to promote the engagement of citizens in the design and co-creation of Smart Cities.

The Manifesto was the outcome of a co-creation experiment, carried out over one year, that has seen more than 50 stakeholders, representing different sectors of the economy, engaged and actively contributing to shape its contents. The primary goal of the Manifesto is to foster knowledge sharing of best practices and collaboration on the co-creation of models that use innovative solutions for ameliorating the civil society, with a particular focus on the engagement of weaker and excluded categories.

In so doing, it calls for commitment towards the improvement of the quality of life by tailoring city measures on citizens' needs. In particular, by outlining its principles, the declaration urges cities to adopt inclusion policies, to educate both city officers and citizens on this matter, to set up collaborative models, to enhance digital literacy, to promote open science and open data as well as to seek co-operation with other cities to strengthen the Smart Cities Network.

To date, the Manifesto has been endorsed by more than 130 private and public sector representatives, reaching multiple European and international stakeholders. To ensure a wider geographical and, thus, language coverage of the Manifesto, various translations of the document have been made available. The so-called *'Manifesto goes local'* campaign, currently ongoing, is facilitating the dissemination of citizen engagement principles also in areas where English is not widely used.

Aiming at having an increasing number of cities endorsing the Manifesto, implementing and, consequently, promoting its principles, with the ultimate goal of making smart cities more inclusive, the Action Cluster has started the assessment of the Manifesto's principles implementation. The analysis, conducted via interviews and an online survey, aims at finding citizen engagement's best practices, solutions and collaborative models to be disseminated and replicated on a larger scale. In particular, data and information are gathered around the six main domains characterising the Manifesto. Results of the analysis can offer examples of obstacles and solutions, showcasing for each of the above mentioned domains, practical examples. Outstanding cities, upon the evaluation, will be nominated 'Ambassadors' and will contribute to the dissemination of the Manifesto principles, while participating to peer-learning and other knowledge sharing exercises.

Technical and financial readiness checks

Project are assessed on the basis of two main criteria, the technical readiness and the financial readiness. The project associated with the application must be well advanced in technical terms (design, approvals, permits, consultation, interfaces, procurement, etc.) and financial terms (business case development, availability of funding-affordability, availability of private sector financing and commitment of the latter in terms of achieving financial close within the timescales set in the call, etc.).

Key matters considered by banks/investors when financing a project

The following list include due diligence items that a lender may consider when assessing a project for lending purposes. Please bear in mind that this list is not exhaustive and only indicative, as different banks/investors have different approaches to project appraisal.

- Demand/needs analysis supporting the project decision
- Option analysis and a good quality Cost-Benefit Analysis based on realistic data and forecast
- Relationship of the project with the existing infrastructure and impact of the former on the existing sector (transport/energy) system
- Medium-term investment plan and business case to support and justify the project and/or the replacement strategy of previous fleets or infrastructures. The basis should be the transport/energy needs of the reference area in the city, in conjunction with operators' organisation and structure for Operation and Maintenance and with the overall city mobility/energy organisation and policy.
- Technical feasibility, status of design development, proven quality of the assessment of project costs (whole life project costs approach)
- Strength of the political support to the project, especially in terms of affordability and funding
- Financial analysis of the project and its impact on public budget

- Status in terms of Environmental Impact Assessment, required studies and their approvals, stakeholder consultation/approvals, administrative/statutory approvals (including at city masterplan level) and all project interfaces
- Clear project structure (who does what) including risk allocation (who takes what risk), in terms of project preparation, procurement, construction, operations, revenue risk, repayment of the loan, etc. (the list of project risks is much more extensive, this are just an example)
- Status of the procurement process and procurement strategy for the delivery of the project
- Clear identification of the funding and financing structure, including identification of the borrower
- Credit risk assessment of the borrower and/or guarantor associated with the loan

EXAMPLE

In March 2015, the "Smart Cities & Sustainable Development" programme developed by the EIB and Belfius Bank aims to assist and provide financial support for towns and cities – including the smallest ones – for their sustainable mobility, urban development and energy efficiency projects. Belgian local authorities have been the first in Europe, starting in June 2014, to benefit from preferential rate loans for implementing their "Smart Cities" projects. With 400 milions available, within ***nine months the progress has been excellent: the first loans, totalling EUR 35m for eight concrete projects in Belgium, have been*** **approved**

Belfius Bank requires the Promoter to ensure that contracts for the implementation of the project have been/shall be tendered in accordance with the relevant applicable EU procurement legislation (Dir. 2004/18/EC or 2004/17/EC and Dir. 2007/66/EC [amending Directives 1989/665/EEC and 1992/13/EEC]), with publication of tender notices in the EU Official Journal, as and where required. In some cases schemes may be developed by private entities which are not subject to the EU procurement directives.

Photo credits: Shutterstock

4 STAGE 4: REALISING THE PLAN(S)

4.1 Background

Following the **PLAN** stage, where action plans have been validated, ranked and operationalised, the actual implementation of the project starts. Standard project management tools will play a more prominent role here. However, as many smart city and low energy district plans may have an experimental character to some extent, the realisation of the plan is not entirely predictable. In particular smart city plans have innovative technologies and novel approaches at their heart, but their actual performance and appropriateness can often only be fully assessed afterwards. Therefore adjustments, alterations and amendments can be expected at this stage, in close relation to the next stages of CHECK and ACT. Further, the ICT component is even more important during this stage, for instance through the establishment of an urban platform enabling not only smarter operations of urban infrastructures, utilities and buildings, but also smarter (re)design of cities and districts and smarter provision of services.

4.2 Checklist for the DO stage

Not surprisingly, the **main question** at the **DO** stage is: "**How to implement the action plans for smart and sustainable cities in order to achieve their targets?**" This implies various TO DO's. First of all, a skilled local team should be composed, consisting of the city administration and key stakeholders. It can be the same team as the team that worked on the preparation of the plan, but it might also be a (partly) newly formed team.

Subsequently, the city administration and relevant stakeholders must allocate resources to the team, such as budget, capacity etc., for the execution of the plan. At this moment, the team must draft a detailed action and/or project plan, by using a standard approach to project management. Usually this entails the organisation of a plenary meeting with all stakeholders for the kick-off of the action plans and/or projects. Meanwhile, the monitoring process should be set-up in more technical and organisational detail, and, most importantly, a "snapshot" should be taken of the current situation to be able to track progress during implementation. Subsequently, the team must organise access to relevant data and enable its sharing through the chosen urban platform. The team will also start executing the actions agreed upon in the project or action plan and manage overall progress.

Useful **tools** at this stage are: detailed risk management, living labs, testbeds, experimentation zones, trial and error, Smart City Information System, and traditional project management tools such as regular progress meetings and reporting. Helpful **standards** are: ISO 3715X Identify Infrastructure Issues, Identify Multi-sectorial Issues, ISO 37101 Management System, ISO 3712X Set Indicators for Progress, Follow-up and Reporting, to help implementing the action plan, ISO 37101 Quality Management Systems Approach.

Finally, this stage results in **achieved goals of the action plans and/or projects**, and progress towards KPIs that have been previously agreed upon.

Figure 4-1 Checklist of TO DO's at the DO stage

STAGE 4: DO

Question:

How to implement the action plans for smart and sustainable cities in order to achieve their targets?

TO DO 1: COMPOSE A SKILLED LOCAL TEAM
with representatives of the city administration and stakeholders with roles and responsibilities

TO DO 2: ALLOCATION OF RESOURCES
to the team(s), such as budget, capacity etc.

TO DO 3: DRAFTING A DETAILED ACTION AND/OR PROJECT PLAN
by defining actions in dialogue with the stakeholders

TO DO 4: ORGANISATION OF THE KICK-OFF
of the action plans and/or projects

TO DO 5: SET UP THE MONITORING PROCESS
by defining the baseline information, define monitoring methods and protocols in detail, choose KPI's

TO DO 6: START ORGANISING ACCESS TO AND SHARING OF RELEVANT DATA AND PROJECT INFORMATION
through an urban platform

TO DO 7: EXECUTION OF THE PROJECT(S)
and management of progress

Tools & standards

TOOLS:

- risk management, living labs
- testbeds
- experimentation zones
- trial and error
- Smart City Information System
- traditional project management such as regular progress meetings and reporting

STANDARDS:

- ISO 3715X Identify Infrastructure Issues
- ISO 3715X Identify Multi-sectorial Issues
- ISO 37101 Management System
- ISO 3712X Set Indicators for Progress, Follow-up and Reporting, to help implementing the action plan
- ISO 37101 Quality Management Systems Approach

Output:

achieved goals of action plans,

progress towards KPI's

TO DO 1: COMPOSE A SKILLED LOCAL TEAM

with representatives of the city administration and stakeholders with roles and responsibilities

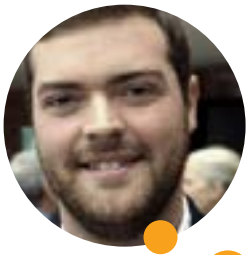
4.3 How?

The execution of the action plan or project might require different competences and capacities than its preparation. Therefore, **for the second time a skilled local team must be composed**. This team should have representatives of the city administration and key stakeholders on board, with roles and responsibilities in the assigned action plan and/or project are agreed upon and clearly described. It can be the same team as the team that worked on the preparation of the plan, but not necessarily so as other competences and skills, or other roles and mandates, might be needed for implementation of the plan. The responsibilities and mandates of the team members must be clearly related to the structures (organograms) of their respective organisations.

Staff competency and capacity are crucial for successful implementation of action plans or projects. Therefore, the chosen team must not only have the technical and organisational competences and skills to realise the plan, but this must also be in sufficient quantities. While in theory, smart city and low energy district projects should be rearranging the city workload and not adding to it, this may not be easily visible in the first stages of project implementation. The best advice for this challenge is to prepare accordingly. This includes checking to make sure that commitments from internal and external partners have a solid basis and that there is enough talented, and flexible, staff to accommodate project needs.

Once the commitments are checked and the available staff is compared with the necessary staff, in both quantity and competency, the budget may need to be revised in order to accommodate additional training or hiring of staff. Especially technical or interdisciplinary competences in the city administration might fall short of what is needed (see for example OECD, 2016).

Easy options for (post-graduate) training might be the establishment of curricula or academies with local research institutes such as universities or RTO's. Lastly, the exchange of personnel in collaboration with (local) businesses, and traineeships and internships might be helpful to raise the technical competences of the staff.



MIGUEL GARCIA-FUENTES, HEAD OF ENERGY, STRATEGY AND BUSINESS DEVELOPMENT DEPARTMENT CARTIF

The Urban Regeneration Model from REMOURBAN supposes a step beyond current practices in the field of addressing cities' sustainability and smart transformation. It integrates mechanisms to empower the stakeholders that belong to this process at the different stages, while provides mechanisms to define, implement and evaluate integrated strategies for these ecosystems.

EXAMPLE: DIFFERENT ROLES AND ACTORS PER STAGE FROM PLANNING TO IMPLEMENTATION

The **Urban Regeneration Model** (URM) developed within SCC-01 REMOURBAN project, provides solutions in both technical and non-technical fields addressing the long-term goals, the main Smart City enablers within urban transformation processes and innovations in the priority areas of energy, mobility and ICTs. Its main objective is to accelerate the transformation of European cities into smarter places of advanced social progress and environmental regeneration, as well as places of attraction and engines of economic growth. The URM defines a procedure composed of several phases and decision-making processes which define the city's objectives and translates them into a set of strategies for a sustainable and smartness-oriented regeneration of the city. By providing better tools and mechanisms, URM improves communications among stakeholders and contributes to better decisions.

Figure 4-2 Overview of the Urban Regeneration Model Source: REMOURBAN (2018)

Especially interesting is how, during the implementation stage, the combination of the overall Integrated Urban Plan, a preferred urban development scenario, and a proposed Action Plan are translated into an Implementation Plan. A profound diagnosis of the current situation in the area where the intervention is planned and an establishment of the baseline information, next to a detailed design for the area of the planned interventions, are key elements in this. In all stages, the URM methodology pays special attention to management, assessment and evaluation of impact, and financing of urban transformations. **Per stage, different roles and actors are driving the results.** Regarding management, during the action design phase, co-ordination committees, knowledge institutes and transformative alliances steer the process of action design. During the implementation stage the commitment of major political groups, different stakeholders and the general public is critical. A design team of engineers and architects plans the interventions and implementation of projects, while a contractor is responsible for site management. Local governments check whether the proposed interventions fit their long-term goals, while financial institutions will appoint a certifier to ensure the planned performance of the project. The five REMOURBAN cities (Valladolid, Nottingham, Tepebasi/Eskisehir, Seraing and Miskolc) have been working towards designing and implement different stages of this model, benefiting from it and leading to deliver Integrated Urban Plans and Action Plans for their cities (REMOURBAN, 2018).

EXAMPLE: EDUCATION OF MUNICIPAL STAFF IN ENERGY TRANSITION
"Municipality staff including planners, district level regeneration management and economic development teams have often yet to have the training in how to successfully bring about a transition to low energy for an urban area. The collaboration of industry and academic bodies to catalyse the learning processes within local authorities has produced effective dissemination of new ideas across fast paced areas of change such as healthcare and low energy should be no different" (Rivada et al., 2016).

WHY? For a well-equipped team, **existing staff should possess sufficient technical and organisational competency, as well as have sufficient staff resources at its disposal, in both time and numbers**. Staff competency and capacity are tricky issues to deal with at the level of project implementation. The lack of capacity in either subcategory is difficult to remedy in the time span of project implementation. Public hiring practices may suffer from the same complexity or convoluted process as other administrative issues, resulting in a possible delay in project implementation if requirements are not caught early enough and remedied quickly.

TO DO 2: ALLOCATION OF RESOURCES
to the team(s), such as budget, capacity etc.

The next TO DO is that of resources, such as budget, capacity, workplace, etc., must be allocated to the team(s). There can be more teams working in parallel on different parts of the action plans and/or projects at the same time. These **resources can be made available by the city administration, but also by stakeholders, investors and other financial parties, or regional and national government**. The budget will most probably include expenses for acquiring specific technologies or for contracting construction or refurbishment works. PPPs can make specific arrangements among their partners. A part of the resources might be covered by subsidies, research funding or pre-commercial procurement. Further, by relating the action plan or project to smart specialisation strategies, it might receive regional economic incentives. Many smart city and low energy district plans combine different forms of finance and funding to develop a solid business case.

EXAMPLE: RESERVE HOURS FOR STAFF BEING PART OF THE IMPLEMENTATION TO FOSTER PARTNERSHIP AND LEARNING SCC-01 project Smarter Together proved that partnership between governments, citizens and businesses liberates huge potentials that are not possible in a conflict-oriented societal context. Partnership provides also the environment for learning and organisational

development and motivates actors to make their contributions. It also strengthens the credibility of governance and politics that is so crucial for getting the citizens/ inhabitants on board and creates positive social dynamics. Process- oriented learning on the spot is much more efficient than imposing top-down solutions in an environment with possibly mistrust. It is also much more motivating. This is a major change in the communication culture amongst actors and the perception of the "other". Smarter Together demonstrated that small steps rather than big unrealistic claims provide the actors the trust-worthy environment of learning without being criticised. Through the process, all actors learn and increase trust in the other. This fosters positive social dynamics. All project activities are a playground for integrative communication as well as for the development of a positive organisational culture. Communication, awarding and motivation target the human dimension of development.

Figure 4-3 Staff being part of the implementation to foster partnership and learning photo credits: PID/Christian Jobst

Smarter Together Vienna determined from the start a sufficient amount of person months in the project management plan in order to enable staff to be included in the implementation process rather than only in the implementation of minimal tasks. Project partners have on one hand clear targets. On the other hand, the project environment provides the framework for creativity that is awarded through communication (for instance project website and newsletter). The involvement in the project of staff from different departments stimulates interdepartmental cooperation beyond the usual competence-oriented cooperation. At the same time, international cooperation provides a wider visibility and importance to local action that is motivating locally.

EXAMPLE: APPROVAL OF PROJECT PLAN BY THE CITY COUNCIL WITH THE BUDGET When asked the question "If the project were to start now, knowing what you've learned so far, what would you have done differently?" one interviewee was very quick to reply: "Well I think I would have started with more staff. This sort of project should not be started with only one person. I also would have presented it to the city council with a budget. And of course, if you want a budget you also have to define goals. So, make it measurable from the beginning " (Interviewee #5, 2017).

WHY? Staff capacity refers not only to the competencies of the staff but to the quantity of available resources, in both available working hours as well as number of competent people. Many smart city and low energy district projects have found that **a lack of available staff within city administration or relevant public institutions that have the experience, skills, or ability to deal with innovative initiatives and solutions is often a limiting factor** (BEEM-UP, 2017; Rivada et al., 2016). Innovative or integrated projects in the field of smart cities and low energy districts may also be very time-consuming tasks, requiring the attention and commitment of dedicated staff (CITYnvest, 2017). Finally, implementation of smart city and low energy district plans might require additional finance, so costs of investments should be justified in the budget and not be underestimated.

TO DO 3: DRAFTING A DETAILED ACTION AND/OR PROJECT PLAN

by defining actions in dialogue with the stakeholders

Subsequently, a **detailed action and/or project plan has to be drafted with the help of standard project management tools** for the next TO DO. Standards project management tools provide a wealth of information on this.

WHY? The detailed action and/or project plan **explains comprehensively what has to be done in what way, within a specific timeframe**. Besides, it clarifies the tasks and responsibilities during the implementation phase. Finally, it makes it possible to track the progress of the project with the help of monitoring.

TO DO 4: ORGANISATION OF THE KICK-OFF

of the action plans and/or projects

After this, a plenary meeting of the city administration with preferably all stakeholders must be organised, for an official kick-off or **start of the action plan and/or project**. This could also be in the form of public meetings or hearings, if possible on the site of the smart city or low energy district plan.

EXAMPLE: SIMMOBILE, A MOBILE URBAN LIVING LAB Not a traditional project kick-off meeting, but a big success! The SIMmobile which the City of Vienna used in Smarter Together, proved to be highly effective in engaging citizens and other stakeholders in comparison to more traditional hearings. The SIMmobile was set for a period of 3-6 week in a row (2-3 days a week) on public places related to the project implementation. Numerous local institutions were also invited to use the ULL as a tool for self-promotion. Specific children focus was developed too. Surveys on variable levels were made. For instance, pupils of the school that had been up-scaled in the project were asked about their wishes with respect to the design and installations of the future building. Employees of the biggest industrial site (Siemens) were asked about their mobility ideas. In both cases, the results were transferred to decision makers, architects and the managements. As a result, inputs and ideas were taken into account and partly implemented. Special gamification tools were developed too (energy quiz) or workshops provided (by Science Pool). The SIMmobile provided an opportunity for communication with citizens that would have never been reached out in the closed set-up of its few branch offices in the city.

Figure 4-4 SIMmobile (photo credits: PID/Christian Jobst)

WHY? This meeting has several purposes. It marks the official launch of the action plan and/or project. Also, participants get a **shared understanding of the project's ambitions**, in case they might not yet have been fully up-to-date on this, and the selected actions being used to achieve these ambitions. Participants can relate to the proposed actions to their own responsibilities and competences, to further prepare for their role in the action plan or project. A proper kick-off meeting can contribute much to **team-building**, especially when team members meet their fellow team members for the first time. From a communication viewpoint, it increases the **external visibility** of the action plan or project and enhances the smart or energy efficient city brand of the city and community.

TO DO 5: SET UP THE MONITORING PROCESS

by defining the baseline information, define monitoring methods and protocols in detail, choose KPI's

Successively, the earlier preparations of the monitoring process during the **PLAN** stage must be elaborated in more detail. A very important part of this TO DO is that a **"snapshot" of the current situation** should be taken, the so-called baseline, for comparison of KPIs during the **CHECK** stage (see also section 5.3). In addition, **qualitative and quantitative KPIs, including financial and performance indicators, must be finally chosen** after consideration at the **PLAN** stage. Advanced Horizon2020 SCC-01 projects advocate the inclusion of some KPIs and value capture techniques for process learning as well, as this appears to be less often highlighted, but a major positive outcome of SCC-01 projects (Evans, 2019). Once the KPIs are known, the **methods and protocols for monitoring** should be defined in detail. Data collection for the baseline can start after it is clear which methods and protocols should be used.

Key Performance Indicators

As explained earlier, KPIs are relevant indicators that have been selected for ensuring the agreement of stakeholders on targets, on evaluation and on monitoring. Indicators can be either quantitative or qualitative. The **values of indicators must be assessed following standardised methods**, as this facilitates comparisons between different action plans or projects. This feeds a benchmark of best practices, and helps in defining targets for action plans or projects about to start, based on validated success stories.

Several management systems and initiatives for a smart and sustainable development of cities and communities have been implemented in Europe and even worldwide, in particular the Covenant of Mayors for Climate and Energy (CoM), the European energy award (eea) management system, EUROCITIES' framework, Horizon2020 CITYkeys project, the Smart City Information System (SCIS), and Horizon2020 ESPRESSO project. These management systems, projects and initiatives have been engaged as active partners within the EIP-SCC and collaborated intensively in workshops and meetings to define basic sets of KPIs for smart, sustainable and energy efficient cities.

While there are many different types of European cities and communities in terms of size, domain of responsibilities, development, culture, historical context and local specificities, the overall picture is that specific sets of KPIs can be proposed and serve as a point of departure for all other city administrations, while being flexible enough for different situations and conditions. So far, four different purposes for KPI usage, each with a different scope, have been identified:

1. Programme evaluation and management (more overall view)
2. Project evaluation and management (rather sectorial approaches)
3. Reporting and communication (internal and external, including to citizens)
4. Benchmarking related issues (feeding a benchmark of best practices and success stories)

For each of these purposes, five main categories of KPIs have been defined, common to all programmes, projects and action plans. These main categories can be subdivided as follows:

Category 1 – PEOPLE: health, safety, access to services, education, social cohesion, mobility, noise and silver economy;

Category 2 – PLANET: energy, climate resilience, water, waste, pollution and ecosystem;

Category 3 – PROSPERITY: employment, equity, green economy, economic performance, innovation, attractiveness and competitiveness;

Category 4 – GOVERNANCE: organisation, community involvement, training, procurement, multi-level governance, development and spatial planning;

Category 5 – REPLICATION/SCALING-UP: scalability, replicability, local co-operation and cross-cities/communities co-operation.

It is advocated to take these KPI (sub)sets as a point of departure when the monitoring process is actually set up in the DO stage, and KPIs have to be chosen.

EXAMPLE: EUROPE-WIDE KPIS FOR SMART CITIES The CITYkeys Framework is a means for strengthening European smart cities strategic planning processes, monitoring their progress and collecting the cities' experience. Within the framework, CITYkeys developed two sets of indicators, the first level of indicators is about the cities and the second level is about projects (Huovila et al., 2017). The CITYkeys Performance Measurement Framework supports the following activities among others:

- Monitoring of the progress in urban development and ongoing projects;
- Evaluation of projects after completion;
- Measuring changes in the city after implementation of the smart city project;
- Comparing the existing situation (baseline) with the expected impact;
- Stimulating cross-departmental collaboration;
- Comparison of projects with each other while tracking one's own projects' performance;
- Tracking the progress on overall policy goals of a city and provide a benchmark for comparing cities with each other.

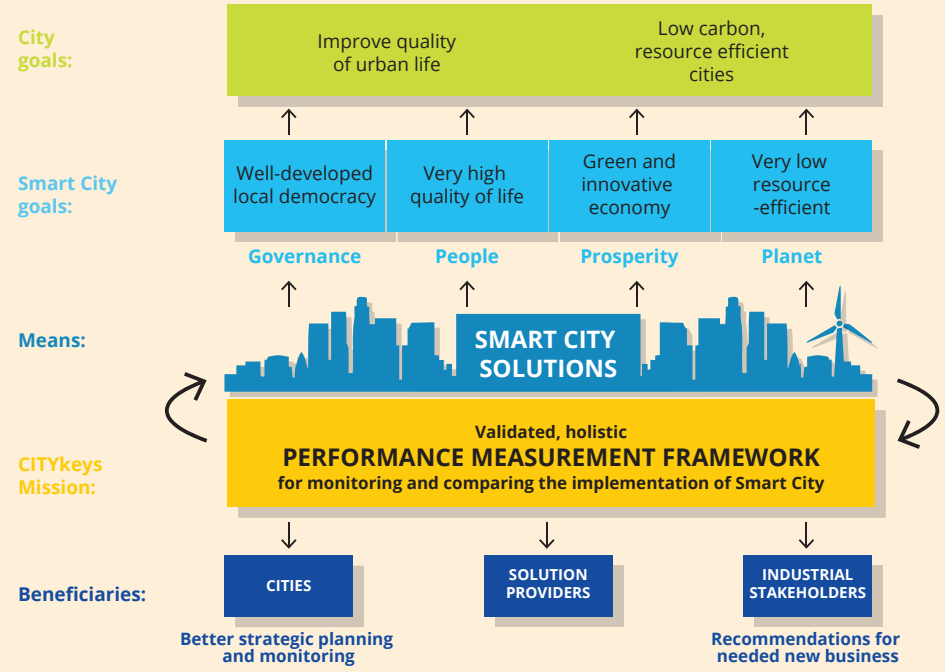


Figure 4-5 Goals of CITYkeys. Source : Huovila et al. (2017)

WHY? The importance of comparable KPIs for monitoring and benchmarking is commonly acknowledged, and several models and sets of KPIs have been developed and are in use today. However, the larger part refers to **measuring the outcomes of actions as part of an evaluation afterwards** or for making comparisons, without **using these KPIs to actively follow and steer progress during implementation**. Only a limited number of approaches and initiatives cover the entire sequence of stages in setting targets and following progress, in helping to develop a consensus-based strategy, in managing its integrated plans, in improving collective awareness and in contributing to new organisational and governance models that are results-oriented.

An overview of these few integrated, cross-domain management systems:

- The European Energy Award quality management system has been developed by cities for cities. It has been implemented for more than 25 years, in approximately 1500 cities and communities so far;
- The Covenant of Mayors for Climate and Energy, with close to 8000 cities and communities committed in Europe, and 6000+ SEAPs (SEAPs) and SECAPs (SECAPs) already developed, thanks to a strong political commitment;
- More recently, ISO has developed a sustainable communities management system – ISO 37101 - with the same concept as other ISO management systems (e.g. ISO 9001, 14001, 50001). These ISO standards and eea model are fully consistent, and can be implemented simultaneously; more importantly even, eea can play a major role in preparing the scene by fostering a culture of holistic, integrated management, such as for ISO 50001 or ISO 37101 implementation.

These models of management systems are also very useful for **raising awareness among all stakeholders and for knowledge transfer**, thus providing all interested parties with an improved level of knowledge and appreciation of what smart sustainable urban development entails. This is essential for achieving consensus with regards to vision, strategies and objectives.

Main initiatives advocating implementation using KPIs for tracking and steering, but also for strengthening mutual collaboration, are the following:

- Citykeys H2020 project;
- SCIS;
- ESPRESSO H2020 project:
- The European Energy Award and its set of KPIs;
- The Covenant of Mayors for Climate and Energy initiative with SEAP and SECAP targets;
- Standardisation with, among others:
  - ISO 3712x series of indicators, for smartness, for sustainability, for resilience.
  - ITU U4SSC model, in as tool for UN Sustainable Development Goal 11 (smart cities and communities)
  - For the development of sustainable communities. These are also available in some countries in contextually adapted versions
  - BREEAM Communities: Criteria and methods for selecting and deciding upon criteria

TO DO 6: START ORGANISING ACCESS TO AND SHARING OF RELEVANT DATA AND PROJECT INFORMATION

through an urban platform

The next TO DO is that the team must start with organising **access to, and sharing of, relevant data and project information through an urban platform**. Data availability, modes for sharing, and interoperability can be difficult issues to solve during the implementation of smart city and low energy district plans.

There are several ways municipalities can work to improve data availability and interoperability, and enable the sharing of data to facilitate innovation. The development of a standardised protocol for data interoperability between localities could solve many of the issues of different cities and organisations adopting different protocols (Stacey et al., 2016a). The statistical office of the country could be tasked with providing access to the data, maintaining its quality, structure, and interoperability (Di Nucci, et al., 2010). Municipalities often lack the staff or technical capacity to **create and maintain open data services in house** (Rivada et al., 2016), but the scale of these needs would be lessened with a standardised approach involving built-in interoperability.

Other solutions entail development and application of standards, and **development of shared urban platforms**. For instance, the FIWARE open source initiative defines a universal set of standards for context data management, which facilitate the development of Smart Solutions for different domains, such as Smart Cities, Smart Industry and Smart Energy (FIWARE, 2019). FIWARE standards are applied in several SCC-01 projects (see section 4.4).

EXAMPLE: MUNICH SMART CITY APP The Munich SmartCity app is an example of how to make an existing offer smarter – within the Smarter Together project the Munich app became the Munich SmartCity app in January 2018 by adding additional smart services as well as a more user-friendly design.

Figure 4-6 Munich Smart City app. Source: Smarter Together (2019e)

The new smart app services are worth a closer look: When a user opens the app, the home screen displays information about their current location and smart services offered there. Mobility service is one of the central functions of the app: In the interactive city map they can find public transport, cycle hire, car sharing services, and pedestrian paths. Another central function is the integration of digital municipal services (eGovernment services). Apart from the new services, the app provides users with tips on top sightseeing spots, events and the cinema program.

Additionally, the Munich SmartCity App is the central access point for services and smart data from all the innovations developed within the Smarter Together project that are of interest for Munich citizens – for example the measurement data concerning air quality or parking information measured by sensors that are fixed at the smart lampposts installed in the project area.

EXAMPLE: IN-HOUSE KNOWLEDGE OF TECHNOLOGY AND PROCUREMENT TO PREVENT VENDOR LOCK-IN "Bristol is alert to this issue. 'We are not going to rely on a vendor to sort this out for us,' says [Paul Wilson, managing director of Bristol Is Open, the smart city unit for Bristol, England]. "If you outsource to a consultant, you can end up with lock-in. The local authority has been astute enough to hire people with quite sophisticated technology and procurement backgrounds to say: we are the city and we are the platform. We know our strategy and we will go to vendors to fulfil aspects of our strategy." (Pringle, 2016b).

EXAMPLE: ELECTRIC MOBILITY MANAGEMENT PLATFORM FOR E-TAXIS In Florence the transport sector has the largest impact on GHG emissions, with 34.5% of total CO_2 emitted. The city, congested as it is by commuter and tourist flows, needed a substantial, integrated action to achieve the significant reduction in the environmental impact of its mobility targeted for 2030 in its Smart City Plan. In recent years, policies consisted of both the technological modernization of the circulating fleet and the promotion of low-impact mobility and public transport. As part of that, e-mobility has been promoted for 20 years now, since the first charging pole in Italy was installed in Florence: starting from the public tramlines, the municipal fleet, the e-sharing service, the public recharging network and several incentives such as free parking for e-cars. Supporting measures, such as a Smart and Resilient Grid and a Smart City Control Room, have been deployed in parallel to enable this transition of urban mobility. As a part of public transport, the taxi fleet presents particular needs in terms of autonomy and charging periods while it is a powerful dissemination channel for e-mobility to city users. In the REPLICATE SCC-01 lighthouse project, the switch to electric vehicles of the public taxi service has been propelled, not only to increase its sustainability but also to promote the electric mobility to city users.

In the partnership, the city administration regulates the public service, defined the sites of the Enel Fast Recharge Plus, and created exclusive areas for new e-taxis recharging. E-distribuzione has selected the technology and is responsible for its management during the SCC-01 project, while Mathema has developed an app for taxi drivers. With the app, taxi drivers can choose the superfast charging pole, choose the plug and book, and it will be blocked and reserved for the taxi driver who booked. The municipality published a dedicated tender exclusively for e-taxi service (70 new licenses dedicated to e-vehicles) with a 25% discount and provided agreements with vehicles producers for special purchasing conditions. In parallel, e-distribuzione installed six new Enel Fast Recharge Plus 1G (EFRP) charging stations, for exclusive use of taxi in public areas identified together with the Municipality and with the taxi drivers' association. The stations have been installed at crucial transport network nodes, for example near the main station, the airport and the main access points to the city. The EFRP charging stations are fully integrated in the low voltage distribution network in a "smart way", ensuring the security and the stability of electric system, with the possibility to modulate the current of each charging, thanks to the remote control by the Electric Mobility Management (EMM) Platform.

Through the EMM Platform, all charging stations are managed in an interoperable way, non-discriminatory access and multi-vendor approach, thanks to the smart meter technology, thus assuring benefits to the end-user guaranteed by free market competition. The full integration of the electric vehicle supply equipment in the low voltage distribution network and the management based on the EMM Platform provide the possibility to manage in a better way energy flows avoiding networks overloads on one hand and, and enabling new customer experiences based on innovative services and solutions in other hand, such as:

- the possibility to identify the closest fast charging point and reserve it through mobile phone (Mathema's app available for taxi drivers);

- monitoring and controlling of charging process;
- load modulation;
- payment of charging directly in the bill, according to the tariff profiles signed with the drivers' own retailer.

This will foster the development of electric mobility without compromising the safety of systems and the quality of supplying for other customers.

Figure 4-7 Opening recharging stations exclusive for e-taxis in Florence. Source: REPLICATE

EXAMPLE: SMART DATA PLATFORM AND DATA GATEKEEPER CONCEPT

To save energy, reduce CO_2 emissions and facilitate a cleaner, cleverer flow of traffic and many other challenges, for a smart city the use of digital technologies is indispensable: for up-to-date information, communication, data exchange, planning, analysis and connectivity. The City of Munich, in the context of the Smarter Together project, has built a "Smart Data Platform" to collect and handle all generated smart city data accordingly. The "Smart Data Platform" offers several interfaces to enter the data from different use case scenarios of the project Smarter Together (e.g. energy, sensors and mobility stations). Data formats and protocols are all based on open standards. The platform allows analysing the available data and provides the results into an analysis dashboard. Selected results are accessible for a broader public via the Munich SmartCity app. Depending on the use case, the platform's analysis engine can combine several data sources and merge the information to show dependencies and patterns between the different sources of information.

The City of Munich, a trusted authority for the administration of data, has committed itself to involving all relevant stakeholders and defining suitable conventions and rules in the context of possible fiduciary and business models relating to the use and provisioning of data. This information and these transparency rules were described and discussed in a "Data Gatekeeper" concept (which can be made available for cities interested in developing smart city data concepts). This paper contains extensive recommendations, "golden rules" and guidelines on trustworthy dealings with data in the context of smart cities. Aspects of importance to all urban stakeholders – from a discussion of relevant paragraphs of the new European General Data Protection Regulation (GDPR) to specific recommendations for technical implementation of rules in the context of data platforms – are sketched in the document.

Finally, a "Transparency Dashboard" was designed to describe all sensors, data analysis mechanisms, and data handling aspects of the project in a most transparent way. The Transparency Dashboard is a Web-side, where Citizens and other interested people get a good project-related overview about which data is generated, how it is transferred and for which purposes it is analysed within the Smarter Together project (Transparency Dashboard, 2019).

WHY? The limited interoperability of different data streams, platforms, and protocols, is a hindrance to fulfilling the full potential of many smart city projects, and, to a lesser extent of low energy district projects. **Maintaining data access, availability, and interoperability while working with different vendors** has also emerged as a looming issue. "Optimisation of ICT and integrated infrastructure will not be achieved if data is not shared and there is not commonality in platforms and protocols" (Stacey et al., 2016a).

Access to data is one of the core principles of many smart city projects. **Collecting and processing data, promoting interoperability, and providing access to that data, while maintaining privacy**, has become a common issue in smart city projects (Interviewee #1, 2017; Interviewee #3, 2017). One of the major concerns with urban information systems is the lack of consistently updated real-time spatial and temporal information required to maintain the utility of the decision-support system (Stacey et al., 2016b).

Furthermore, several projects noted problems with maintaining data availability and interoperability with private contractors – they fear being locked in to **a proprietary platform or protocol** provided by the outside vendor (Veronelli, 2016; Rivada et al., 2016). "In Spain, only some parameters to be measured and controlled are defined by regulations, but in general, there is a lack of normalisation for ICT systems in residential buildings. This fact is a source of difficulties for the Buildsmart project, which includes several numbers of different solutions, and the lack of standardisation makes the integration process more difficult. A special effort had to be made in order to ensure the correct integration of all solutions and the adequate performance of the building as a whole" (Mörn et al., 2016).

TO DO 7: EXECUTION OF THE PROJECT(S)

and management of progress

Finally, the last TO DO at this stage, is **execution of the action plan or project**, and management of the progress. From interviews it can be concluded that quite often smart city and low energy district projects have to make significant amendments and adjustments along the way, due to reasons varying from underperforming solutions to changed priorities of stakeholders that play a key role in implementation.

Often-mentioned is the fact that the implementation of the action plan or project can be hindered by several **challenges related to regulations and legislative frameworks.** The main issues are regulations that conflict with the project goals and lock-in, subsidies, and regulations that favour specific technologies (including competing solutions) or business-as-usual. Another issue is the complexity and possible conflict of regulations at different governmental and regulatory levels (e.g. local, regional, state, country, EU), for instance European rules on competition (Vandevyvere, 2018).

City managers need to direct the city policies and regulations to incorporate a more flexible approach - one that is more welcoming to innovation. This can start with allowing pilots and public procurement processes to permit temporary exceptions to regulations, to allow time for innovative, experimental, or disruptive approaches to test the market and see if there is a public demand for their services. By allowing these innovative approaches to test the field within a living lab, the city is able to set the ground rules for the demonstration site, as well as the parameters required for future expansion or approval of the project approach. Other solutions are to scan the regulatory and legislative framework during the planning and preparation to prevent an impact on the plan. Finally, a smart city plan or project should be encouraged to make proposals for adjustment of the regulatory framework, if needed.

EXAMPLE: AUTONOMOUS VEHICLES ONLY ALLOWED AS EXPERIMENT

“So there is an experimental clause, but we would like it to be more considered, so that we can do autonomous driving and things like that” (Interviewee #5, 2017).

EXAMPLE: ADJUST SOLUTION TO FIT IN REGULATORY AND LEGISLATIVE FRAMEWORK

“Regarding the specific intervention in FASA districts in Valladolid, the proposal has taken into account this obstacle. For this reason, the FASA photovoltaic facade will be connected to an isolated network off-line to avoid paying the toll circuit. The electricity generated by the facade will heat the hot water of the “tower building” through electrical resistance attached to the water tank”(Rivada et al., 2016).

WHY? In some smart city and low energy district projects, **existing regulations may create an impediment to the introduction of innovative, novel, or simply different technologies**. An example of this is with historic preservation rules and regulations that may impact the implementation (or cost-effectiveness of implementation) of energy technologies (e.g. rules requiring clay tile roof tiles where solar PV is not allowed, or exterior brick facades to remain and external insulation is not allowed). In some cases it is even unclear whether innovative approaches conform to the existing regulations, which may have been written in a different technological era (R2CITIES, 2017). A well-known issue in Spain is the Royal Decree 900/2015 on self-consumption of electricity (Ministry of Energy of Spain, 2015), requiring special fees for PV-generated electricity, and thereby discouraging investment in PV installations (R2CITIES, 2017; Rivada et al., 2016). Another issue is the refusal to allow "green" materials into the building code, so compliance with the law entails following the existing business-as-usual approach (Stacey et al., 2016a).

Rules and regulations may be introduced (or already exist) which provide a preference or commitment to specific technologies or approaches. An example of this was a project in Denmark where the implementation of district heating was impeded by a regulated commitment (lock-in) to purchase a certain quantity of gas supply: "…natural gas companies were given the exclusive right to supply certain heating areas in order to ensure that they could finance the development of a national pipeline system around 30 years ago"(Di Nucci et al., 2010).

The existing morphology of an area, including its associated infrastructures, may create an advantage for the business-as-usual scenario. It can be difficult for a new or innovative approach to compete when the infrastructure for a specific approach is already in place. This is visible with, for example, existing electricity infrastructure vs. district heating, or private vehicle on public roadways vs. expanding public transit.

One interviewee mentioned that national legislation and other legal frameworks do often not allow enough space for experimentation, for example in e-mobility projects. As a result, public administration, who are bound to legislation, cannot be as innovative as they want.

4.4 Inspiration

Changing roles of stakeholders during implementation

In the networks where stakeholders in smart city projects are engaged, these stakeholders play specific roles. However, it appears that once the local ecosystem has been formed, it is often quite dynamic, not only by the entrance of newcomers, but also in terms of changing roles. A study by Nijman (2014) analysed envisaged and observed roles of actors during the implementation of the Smart Citizen Kit project, which enabled citizens to measure local air quality in Amsterdam. She concluded that distinctions between design and use of smart solutions and the roles of government and citizen had become blurred. New roles emerged, such as citizens as data producer and co-designer or even co-creator of solutions. But roles changed as well: participating citizens who tested, gave feedback, shared information about their behaviour and had little knowledge on the topic before, became data interpreters, knowledge contributors, helpdesk and guides of the process. The project team became testers as well, helped to smoothen technology and to redevelop the Smart Citizen Kit.

Development of indicators

(Brita Fladvad Nielsen, NTNU, Institute of Architecture and Planning)

It is recommended to use KPIs relevant for each of these categories and subcategories in order to feed benchmarking database in a consistent manner and help in replication/scaling-up.

An indicator should be developed through a logical process. A good way to decide which indicator in each case is relevant and useful, is to use the MADM method. Multiple attribute decision making (MADM) methods described in (Yoon and Hwang, 1995). MADM problems are diverse, but share some common attributes (Yoon and Hwang, 1995):

- *Alternatives*: Each problem consists of a finite number of alternatives that are screened, prioritized, selected and/or ranked.
- *Multiple attributes*: Each alternative is characterised by a set of attributes. The decision maker (DM) must generate the relevant attributes.
- Incommensurable Units: Each attribute has different units of measure (if any).
- *Attribute Weight*: Almost all MADM methods require information regarding the relative importance of each attribute.
- *Decision Matrix*: A MADM problem can be concisely expressed in a matrix format, where columns indicate attributes and rows list competing alternatives.

The MADM process can be split into three steps:

1. *Generating attributes and defining the data*: To establish a foundation for the decision making, the relevant attributes needs to be identified. The term “attributes” can be referred to as “goals” or “criteria”. The set of attributes should represent all the important parameters relevant for the decision. Preferably, the attributes should be broken down to “sub-attributes” until they reach a measurable level. For most MADM methods, it is also necessary to rank or weigh the attributes, as they seldom are considered equally important.
2. *Attribute rating*: All the alternatives must be rated against all attributes. For quantitative attributes, this could be a relatively simple process. For qualitative attributes, this is more complex and requires a more subjective assessment. Many MADM methods require quantitative data for the attribute evaluation, and the qualitative evaluation then has to be quantified.
3. *Applying the MADM methods*: The MADM methods are classified based on the available information. In some MADM problems, it is reasonable to apply more than one method, e.g. apply one method to eliminate the alternatives with unacceptable performance at important attributes, and then rank the rest using a secondary method.

FI-WARE Platform for smart cities

(José Javier Astrain, Institute of Smart Cities (ISC) Public University of Navarre)

Its developers describe FIWARE as “a curated framework of open source platform components which can be assembled together with other third-party platform components to accelerate the development of Smart Solutions” (FIWARE, 2019b). FIWARE aims to be a standard an open platform for smart cities.

The FI-WARE Project (May 2011-December 2014) was funded (~41M€) by the European Union under the programme FP7-ICT. The project consortium (Telefónica, Orange, Engineering and Atos) was led by Telefónica. FIWARE currently has its own foundation, in charge of providing shared resources to help to achieve the FIWARE mission by promoting, augmenting, protecting, and validating the FIWARE technologies as well as the activities of the FIWARE community. Nowadays the community of FIWARE includes more than 1,000 startups, 11 innovation hubs, 2 acceleration programmes and more than 100 cities (FIWARE, 2019c).

ORION context broker generic enabler

The main and mandatory component of a FIWARE platform is Orion. **Orion Context Broker Generic Enabler** manages the context information and brings access to context. Orion allows interacting with IoT (IoT) devices, robots and third-party systems, for capturing updates on context information and translating required actuations (see figure below).

Figure 4-8 ORION context broker generic enabler. Source: FIWARE

Generic Enablers (GEs)

GEs are components that offer, through APIs, a great number of general-purpose functions, easing the development of smart applications in multiple sectors and also the interconnection with other GEs.

FIWARE assembles a set of building blocks (GEs) in order to provide reusable and common shared functionalities to ease the creation of smart applications. Generic enablers concern data/context management, security, IoT, application/services and data delivery, cloud computing, interfaces to network and devices and advanced web-based user interfaces. Figure 4-9 depicts some of the available GEs.

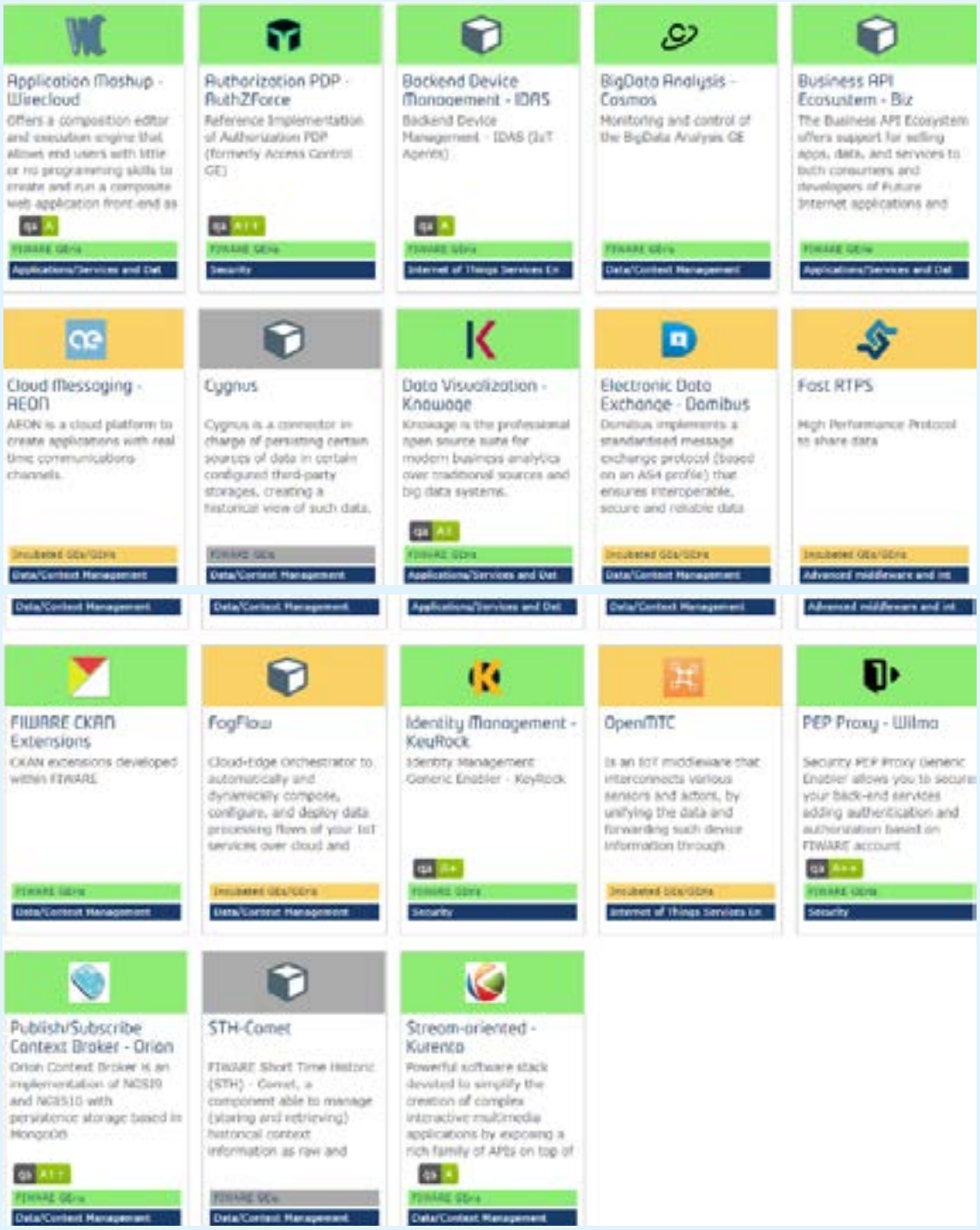


Figure 4-9 FIWARE catalogue. Source: FIWARE, https://catalogue-server.fiware.org/enablers.

FIWARE, by means of GEs, allows the quick implementation of smart solutions by just interconnecting GEs. Results are easily replicable and scalable, and FIWARE allows the development of powerful Apps and data fed in real-time.

Figure 4-10 shows a case study of FIWARE, where we can appreciate the interaction among applications, FIWARE NGSI-10 and the backend. An interesting overview can be found in Salhofer (2018).

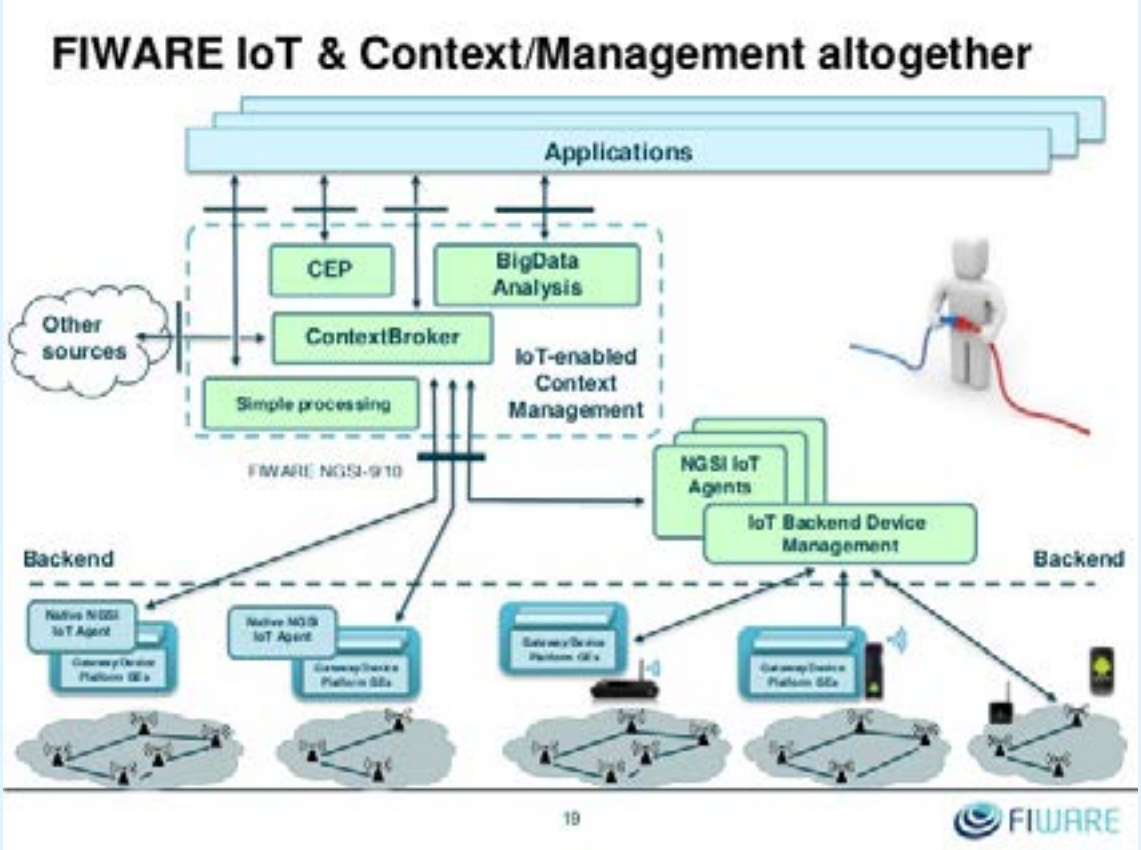


Figure 4-10 FIWARE case study (Source: FIWARE)

Docker images

FIWARE community provides Docker images for every component (FIWARE, 2019e). Docker is a container technology, which allows to different components isolated into their respective environments.

5 STAGE 5: FOLLOWING PROGRESS

5.1 Background

Previous chapters explained the subsequent steps from planning to implementation. This chapter discusses the **CHECK** stage. It explains why common indicators of performance (KPIs) as well as criteria jointly decided upon, must be used for the evaluation of the impacts and results of actions. As previously discussed, **monitoring helps in the first place to steer the project or action plan during its implementation and adjust the actions if needed**. What is more, the use of common indicators also helps to make better comparisons of the performance of specific actions or solutions in different cities. Best practices and "success stories" of satisfactory and effective actions and solutions, are the benchmark for cities that contemplate these actions or solutions for their own jurisdictions, while "failure stories" teach what should be done in a different way. In this way, comparable indicators help to build a repository of validated, proven solutions, which supports cities in selecting the most appropriate types of solutions that meet the city's expectations in the best way.

This chapter will focus on:

- The processes of setting up baselines that adequately reflect the current situation;
- Collecting information on KPIs chosen earlier;
- Interpretation of monitoring information;
- The role of monitoring information for improvement and benchmarks in support of decision making (including investments) and selection of appropriate targets.

No improvement without measurements

When executing programmes, projects and actions plans, regular systematic collection and analysis of information are essential to track the progress in implementation against pre-set targets and objectives. It aims to answer the question "**Did we deliver?**"

Monitoring provides information on where an action plan, project or programme is at any given moment, or how it develops over time, relative to chosen targets and expected outcomes. Besides, monitoring sheds light on the efficiency of the planned or executed actions, and the use of resources this requires from the city administration and the stakeholders. For a city administration, setting relevant targets when the project is planned can be a real challenge that would benefit from a benchmark database of best practices. When actions are actually being implemented in a local context, there is a need to follow the progress of the actions by comparing how the main related KPIs evolve against the targets, and to act by (re-)adjusting the action plans to meet the targets, or, in case the chosen targets prove to be unrealistic, by adjusting the targets themselves. Thus, monitoring of the value of the concerned KPIs is an essential step for further improvement. It is impossible to manage and improve what is not measured. Besides, information coming from monitoring is vital for the reporting and communication of progress with different sectors of the city administration and with the stakeholders involved in the action plan or project.

While monitoring provides records of activities and results, and signals problems to be remedied along the way, **it is descriptive and, as such, may not be able to explain why a particular problem has arisen**, or why a particular outcome was achieved or not. Not monitoring, but evaluation deals with questions of cause and effect, although monitoring data might be used for answering these questions and prepare the evaluation. Evaluation is assessing or estimating the value, worth or impact of an activity or intervention, and is typically done on a periodic basis.

Monitoring is an essential part of the management of complex projects, action plans or programmes, especially when there are permanent improvement strategies in place. However, there is a critical need

for defining what specific indexes best describe the achievement, targets, impacts, and so forth. A common challenge regarding measuring and monitoring of KPIs is that KPIs depend on data availability. The task of monitoring KPI achievements is often given to a public sector practitioner or a consultant. If some of the data are more difficult to acquire than others, the monitoring might become incomplete and some parts of the **VISION** would thus be neglected

To avoid this problem, it is recommended to ensure that all possible end users of the KPI measuring and monitoring take part in the final selection and design of the KPI set. Another way to tackle this challenge when it occurs during implementation, could be to partner with a research institution or a company that can assist in the collection of data, or that can assist in re-designing the indicators to identify more feasible ways to measure the same goal. It is important to have the availability of data in mind when selecting and evaluating the indicator set for each project, action plan or programme.

Benchmarking entails collecting sets of KPI values for a wider group of projects and programmes. This is very useful for comparing the impacts of different options before implementation, as well as promoting success stories and best practices through benchmarks after implementation, a key element for replication and scaling-up. Furthermore, the use of a large benchmarking database helps in selecting appropriate KPIs for setting relevant targets and exploring applicable solutions for new projects and action plans. And lastly, evaluation of the performance of chosen solutions afterwards and entry of this information into a benchmarking database, helps to save and disclose this information for refined use in the future.

One of the main barriers to overcome in smart and sustainable strategies and programs for a city or community, is related to the **unfamiliarity with novel approaches and to the perception of risks**, when it is contemplated to use innovative strategies and policies instead of business as usual. Thus, in order to support decision making as well as better motivate financial investments, benchmarks of success stories and best practices based on relevant and standardized KPIs, are not only particularly helpful in demonstrating potential benefits and assets for cities and communities, but also in indicating the volume of accompanying investments. Identifying similar challenges and validated potential solutions among a long list of success stories, will (re-)assure any decision maker and investor. This replaces the perception of risk with one of confidence and trust, thus contributing to engagement in ambitious but realistic action plans and projects. Such a benchmark of best practices will not only guide advisors and consultants, but also raise levels of expertise among cities' decision makers and project leaders, and among engaged stakeholders.

In addition, accessing and analysing benchmark information can contribute to developing ambitious yet realistic expectations of foreseen targets and ways to meet them, through its reports on existing, inspirational cases. By choosing success stories that are on the leading edge of smart, sustainable and energy-efficient urban development, such an analysis can identify best practices that help to improve their own specific situation and context.

Collecting KPIs from projects/programs implemented in each city or community in a systematic and consistent manner will make it possible to feed progressively a common database that will serve as a benchmark, where any type of city/community should be "represented". With such a major tool, decisions made at city or community level to engage in smart and sustainable development, will be easier, while support for the implementation in terms of finance and stakeholder engagement, will be more consistent and collective.

However, an important prerequisite for such use of KPI-based information is that best practices shall be collected and benchmarked using comparable indicators. If this is not done, the comparison and evaluation of which solution would best meet a city's expectations, will not be possible or relevant. For this reason, common indicators of performances (KPIs), as well as already decided, mandatory criteria, should be used for the evaluation of the impacts and results of actions.

Criteria are different from indicators in that they are a set of key requirements that are mandatory to fulfil for the said project. These requirements are either fulfilled or not, and the further planning and

implementation process depends on this. Next to KPIs, these criteria are also very important for knowing whether a project will be able to meet or has met its intended purpose(s). The BREEAM communities and the ZenN questions in the "Taxonomy of Near-zero Energy Renovation Options and their Influence on Architectural and Cultural Heritage" provide examples of such criteria (BREEAM, 2017; ZenN, 2017). Each project can use these sources to select criteria that might be relevant for their project and the consensus among stakeholders. It must be noted that deciding upon which criteria are relevant, is highly dependent on the national context, as many of these criteria are often integrated into national planning regulations. These criteria can be found by looking at the planning and building acts of each country. One example is the Norwegian criteria that public transport hubs must be within a specific distance from dwellings, and that the positioning of private houses must be so that there is sunlight in the building until at least 3 p.m. in the summer months. In addition, it is possible in many countries to add criteria to the legal agreement between property owners and private developers, which, depending on the national rules on legal agreements on properties, come in addition to these national regulations. KPIs will add decision support service, or 'climate service' tools on top of these criteria.

Standards can support monitoring and benchmarking significantly. Using and referring to standardised KPIs helps in bridging "different languages" and in creating a common understanding between stakeholders, especially between authorities and technicians. In this way, it contributes to an efficient management of the measurement of the progress of the project towards planned targets, and thus to the selection of appropriate corrective actions/adjustments to be implemented during the **ACT** stage (see next chapter). ISO 3712x series of standards are fully consistent with and complementary to ISO 37101 Quality Management Systems Approach. What is more, they contribute directly to quantifying progress for UN SDGs purposes.

The "United for Smart Sustainable Cities" (U4SSC) tool is another useful KPIs related initiative, a UN one, coordinated by ITU, UNECE and UN-Habitat, to achieve Sustainable Development Goal 11: "Make cities and human settlements inclusive, safe, resilient and sustainable". The U4SSC list of KPIs is consistent with the ISO 3712X series. Recently, the Global Standardisation Development Organisations (SDOs) –ISO, IEC and ITU-T – started to join their forces in a single Task Force - Joint Smart Cities Task Force (JSCTF) -, to work together on a common complementary set of standards

5.2 Checklist for the CHECK stage

The main activity at the **CHECK** stage is the continuous assessment of the progress of the project or action plan, giving clues for improvement or adjustment if needed. Measurement of progress and evaluation takes place against the targets as represented by the KPIs. Not surprisingly, the **main question** during the **CHECK** stage is: "**Are we following the right track to meet the targets agreed upon during the implementation of the project?**"

This question is answered by a series of TO DO's. First of all, a platform must be chosen for the monitoring of KPIs as proposed earlier in the **DO** stage. Subsequently, it needs to be checked where the monitoring activities could be aligned with current reporting obligations to prevent twice the work, for instance SE(C)AP, SUMP or national reporting obligations. After monitoring has started, frequent meetings of city administration and key stakeholders need to be organised to check if the expected progress is made and if there are any red flags. Following, together with the partners in the project, it must be explored what it takes to solve these issues or respond to changed circumstances during the **ACT** stage.

The main output of the **CHECK** stage consists of a comparison of the progress against the agreed targets, suggestions for improvement(s) and amendment(s) of strategies, policies and action plans, and appropriate solutions responding to changed circumstances, i.e. technological innovation or political shifts.

Figure 5-1 Checklist of TO DO's at the CHECK stage

STAGE 5: CHECK

Question:

Are we following the right track to meet the targets agreed upon during the implementation of the project?

TO DO 1: CHOOSE A PLATFORM FOR MONITORING
of KPI's

TO DO 2: ALIGNMENT WITH OTHER CURRENT REPORTING OBLIGATIONS
to prevent double work

TO DO 3: ESTABLISH THE BASELINE AND START COLLECTING
monitoring information

TO DO 4: ORGANISE FREQUENT MEETINGS FOR ANALYSIS AND INTERPRETATION
of the information from the team and from the monitoring system, to identify possible problems early

TO DO 5: EXPLORE HOW TO SOLVE POSSIBLE PROBLEMS AND IDENTIFY WHICH ADJUSTMENTS ARE NEEDED
in order to improve the project. Discuss these with internal and external stakeholders in the quadruple helix

Tools & standards

TOOLS:

- software
- GIS
- databases
- protocols
- traditional project management tools
- measuring equipment
- sensors

STANDARDS:

- ISO 3712X Measure Progress towards Planned Targets
- ISO 37101 Quality Management Systems Approach
- U4cities of ITU
- CityKeys

Output:

comparison of progress against agreed targets, suggestions for improvement(s) and amendment(s)

Commonly used **tools** at the **CHECK** stage are: software, GIS, databases, SCIS, protocols, traditional project management tools and exchange platforms. Measuring equipment, for instance for air pollution or smart meters for energy consumption, might be relevant as well, next to GPS tracking, mobile phone data, sensors and actuators. Applicable **standards** are: ISO 37101 Quality Management Systems standard will guide the entire management process from vision to implementation, improvement and monitoring, while SO 3712X series of KPIs related standards, will be used for addressing KPIs to each target, and then measure progress towards the planned targets. ISO 3712X series propose a list of KPIs dedicated to smartness, sustainability and resilience.

TO DO 1: CHOOSE A PLATFORM FOR MONITORING

of KPI's

5.3 How?

The first TO DO for the **CHECK** stage is to **choose a platform for monitoring of KPIs**. There are multiple existing, user-friendly monitoring tools for collecting and storing data with specific information about date and time. For this reason, cities are encouraged to list current platforms and check which platforms are appropriate for their smart and sustainable development, before looking for a new platform. Most of the time, city administrations already have comparable tools in different sectors or departments, but in this case, it is important to centralise these data in one (virtual) single platform. For this TO DO, the team should identify the tools that are essential for an efficient and successful management of the projects, and investigate in detail the interfaces issued to avoid barriers between the different tools.

EXAMPLE: PUBLIC MANAGEMENT OF URBAN DATA SUPPORTS INTEGRATED APPROACH

The holistic, integrated approach of smart city features in the Lyon-Confluence lighthouse project area, worked very well to improve the environmental performance of this urban area in the Horizon2020 SCC-01 project SmarterTogether (SmarterTogether, 2019).

Main achievements of the project are:

- A combination of energy infrastructures by implementing a district heating network powered by renewable energies and doubling the photovoltaic production of this area;
- Energy renovation works for 50,000 m^2 of existing buildings: 500 apartments (private and social housing), office spaces, and public facilities;
- The commission of 40 electric charging stands, the development of an e-car sharing system, and a test of electric autonomous shuttles;

- The collection of data on the Lyon-Confluence area through the city platform (from district heating system, electric grid, new and refurbished buildings, electric mobility services, photovoltaic installations) to monitor the environmental performance of the area.

Some valuable lessons learnt for the Lyon-Confluence urban project and Lyon Métropole (Greater Lyon area) are:

- The energy renovation of existing buildings can be accelerated with an integrated approach, consisting of requirements of high energy performance, transforming buildings into low-energy buildings, integration of renewable energies (e.g. district heating and/or photovoltaic), and collection and sharing of energy data on the city data platform:
- New business models for the production and distribution of renewable energies (e.g. collective self-consumption, blockchain technologies) were tested and proved promising;
- The collaboration between public and private stakeholders for a public management of urban data (energy & mobility data) is a key success factor;
- In the Lyon-Confluence neighbourhood, it's the first time that Lyon Métropole collect and work with energy data. There is a high replication potential at a larger scale, in the rest of the Greater Lyon metropolitan area.

WHY? The monitoring **information needs to be brought together in one, recognisable (virtual) place, the so-called platform**. This might be the same as the urban platform that is part of the **DO** stage, but it is usually an entirely different platform dedicated to only monitoring.

TO DO 2: ALIGNMENT WITH OTHER CURRENT REPORTING OBLIGATIONS

to prevent double work

After that, it is important to ensure alignment with other on-going reporting obligations, to make an efficient use of the resources of the city administration and stakeholders for monitoring activities. It is very well possible that **monitoring activities of this action plan or project can be aligned with other reporting obligations**, for instance for SE(C)AP, SUMP, eea quality management related or ISO 37101 related.

EXAMPLE: STANDARDISATION OF URBAN DATA FACILITATES CROSS-DOMAIN COLLABORATION

The ESPRESSO (systEmic Standardisation apPRoach to Empower Smart citieS and cOmmunities) project developed a "Conceptual Smart City Information Framework". The project involved a wide range of stakeholders, including cities active as Smart City, SMEs, governmental owned organisations, investors, SDOs, and research institutes, and aimed to facilitate communication between them. ESPRESSO identified standardisation priorities of smart cities and related initiatives and fast-tracked them. In addition, the project identified technologies and different information models for smart cities, and established an interface between sector data sources and the Smart City platform. This contributes to alignment with other reporting obligations. ESPRESSO project was developed to create a platform that shows which standards are really urgent and missing, for example, management standards, operational standards, framework standards, or interoperability standards and so forth. Potential gaps and overlaps among the standards which are used in smart cities and smart city initiatives were identified. ESPRESSO provides guidelines, how to use standards in a smart city, and develop roadmaps. Besides, ESPRESSO created a conceptual interoperability framework for smart cities that can help in classifying standards and smart city projects. This facilitates the identification of best practices that are relevant to the city administration's goals and sharing of this practice with interested city administrations and stakeholders (ESPRESSO, 2019).

WHY? The main reason for this TO DO is to **prevent repetition of work for city administration staff**. Reporting progress in many different domains is already an issue for city administrations, as it is very time-consuming. City administrations must report on many levels to authorities, such as the regional, national, EU and global level (such as UN SDGs). When the indicators for reporting are aligned in a way that a single set of KPIs can meet all or several reporting obligations, this will save a lot of time and resources.

However, **not only the KPIs to be collected should be aligned in this TO DO, but also how their data represent them and how changes in their values are interpreted and used**. When all values are available in similar data formats and can meet multiple reporting needs, corresponding to different uses of the data, monitoring activities are streamlined and efficiently organised.

Another reason for this TO DO is that the information collected in this streamlined manner, might also be helpful in identifying potential synergies with other action plans or projects not considered beforehand. This can lead to savings in hours or costs, but also create more impact because different targets may reinforce each other.

TO DO 3: ESTABLISH THE BASELINE AND START COLLECTING

monitoring information

After choosing the platform and aligning with all other current obligations, the **actual monitoring activities for the earlier chosen KPIs**, which reflect the targets of the action plan or project, should start. To be able to make comparisons later with the values of KPIs when the project started, it is important to establish a baseline or "snapshot". This baseline reflects the current situation: the values of all KPIs before any actions were implemented.

EXAMPLE: BASELINE AND KPIS HELP TO CHOOSE THE RIGHT MEASURES FOR CLUJ-NAPOCA

Cluj-Napoca started their participation in eea in 2012 and used the eea method to establish a baseline. The first results compared to the baseline were quite low - 28 % of the city's potential for sustainable climate protection, with underperformance for municipal buildings, internal organisation and mobility. Then, following the eea method, the first measure was to establish an energy efficiency department, which has now five energy managers and then to hire the Technical University of Cluj-Napoca as energy manager. This department updated and elaborated the Energy Efficiency Programme for Cluj Municipality, with the following statistical key indicators: 3.500 GWh/yr city energy use, out of which 12% public users. Actions taken consisted of public communication of the city's energy impact and seven editions of instruction, education and behavioural change workshops for public building administrators. Other actions entailed better co-ordination with the Energy Managers and Energy Action Plans of utility companies (district heating, transportation, water, energy, gas, waste) and the scheduling of substantial investments in sustainability, of which 11,2 M Eur has already been invested in a major renovation of four public buildings, leading to 9.400 MWh/yr energy savings and 3.300 tons/yr of avoided CO_2 emissions. In 2018, eleven electrical buses started to be used in the public transportation with great success, bringing about around 60% energy savings and avoided CO_2 emissions. The project is realised by efforts of the local transportation company and the Municipality of Cluj-Napoca, with the financial support of Swiss funds. In 2018 the training of eea consultants was held in Cluj-Napoca as an example of good practice. What is more, in 2019 Cluj-Napoca was chosen as Best European Energy Service Promoter. This shows that a good overview of the city's key performance indicators can eventually lead to excellent smart solutions. In 2019 Cluj-Napoca is approaching the threshold of compliance with 50% of eea requirements, when it could possibly be awarded with the "European Energy Award" (eea, 2019).

Figure 5-2 eea consultants training in Cluj-Napoca – introducing the new electric buses (Source: eea)

EXAMPLE: CONTINUOUS MONITORING WITH SMART LAMPPOSTS COLLECTING DATA AND OFFERING SERVICES

Modern technologies can make our lives easier: take the example of traffic monitoring or access to data on air pollution, it is much easier and more accurate to collect information continuously than to send people to a certain place and have them count traffic or measure the pollution levels for one specific day. To generate important data for a Smart City, why not use something that already exists within the municipal infrastructure? Lampposts for example are spread all over the city. Equipped with an independent power supply, the right innovative sensors and an internet connection, they can be the ideal IoT access point to collect the needed local data in real time. So, let's make our lampposts smart!

Within the Smarter Together project scope 60 smart lampposts were installed within the project area of Neuaubing-Westkreuz and Freiham in Munich by spring 2018. In addition to their lighting function, the posts have a separate second power supply that allows sensors to measure and capture local data such as air quality, weather and traffic data. The local data can then be transferred to a central smart data platform, edited and made available for further use: for urban planning topics, for display on a city map or incorporated in the Munich SmartCity App or portal that could allow local residents to access and use all kinds of up-to-date status reports. Working together with citizens, Smarter Together defined a framework for the selection of sensors.

This framework includes the requirement that the sensors should not be able to collect personal data, recognise car number plates or recognise faces. In addition, all sensors exclusively face onto public spaces.

Each post is internet-enabled, allowing to transfer the data securely to a central repository. Due to this fact they can also double as hotspots to provide free public wi-fi access via the city's offer M-WLAN. This can bring direct benefits to adjacent cafes, bakeries and snack bars, as it might encourage guests to stay longer. The lampposts are currently used to run trials on different sensors. They are also described as "urban labs" or "real labs" testing digital services and the benefits they provide in the project area. Details can be found online in the transparency dashboard (Transparency Dashboard, 2019).

WHY? Most projects in the field of smart cities and low energy districts, include monitoring activities with the aim of measuring progress. The **baseline information is indispensable for this as it provides the point of departure**. Monitoring is needed to **keep track of progress** in the action plan or project (see section 5.1), or to contribute to benchmarking databases, and the collection and interpretation of information must therefore start after the baseline is established.

DORIN BEU "We must move from the situation when a city is run based on intuition or in a reactive mode. The European Energy Award helps cities to continuously improve by analysing six areas with around 70 measures and especially in East Europe, where few employees have a background in city administration, this will make them more professional, by using other cities experience. Now, data collection is an issue, but in a future smart city this will be done automatically from smart energy meters/ sensors and then, artificial intelligence will help city councils in quick and expert decisions". Dorin Beu, president of Romania Green Building Council

Figure 5-3 SCC-01 Lighthouse project area with smart lampposts in Munich. Source: Dominik Parzinger.

TO DO 4: ORGANISE FREQUENT MEETINGS FOR ANALYSIS AND INTERPRETATION

of the information from the team and from the monitoring system, to identify possible problems early

The next TO DO during the **CHECK** stage is to organise frequent meetings for analysis and interpretation of the monitoring information, provided by the team and by the monitoring system. Potential or expected problems must be identified as soon as possible (are there any red flags?). An **efficient follow-up of progress needs regular and frequent analysis of the monitored data**. The project team needs to consider the monitoring platform as a frequently used tool, which is not only used when the end of the project is nearing. Dependent upon which specific indicator(s) it concerns, this might entail daily, weekly or monthly checks. For example, air pollution will be measured more frequently than the share in the total housing stock of refurbished dwellings.

EXAMPLE: EUROPEAN ENERGY AWARD

An important example of both benchmarking and standardisation is the European Energy Award, see eea (2019) for more detailed information. As a quality management system and certification process, the eea establishes interdisciplinary planning and action as well as a process-oriented and long-term energy and climate protection policy in the municipalities. Under the eea system, a municipality's scope of action regarding energy and climate protection policy covers six main areas:

- Mobility;
- Supply and disposal (electricity, district heating, renewable energy sources, water supply, sewage, waste, and so forth);
- Communal buildings and facilities;
- Urban planning and development model;
- Internal organisation (including continuing training, performance agreements, and planning and controlling);
- External communication & co-operation information.

Citizens are key partners and key players in the eea governance model. More than 1500 cities and communities in Europe have already implemented eea. The basic principle of the eea is the process based on the management cycle of "analysing – planning – implementing – auditing – adjusting" that is typical in the business world, supplemented by the "award". eea is fully consistent with major global quality management systems standards, in particular ISO 50001 (Energy Management Systems) and ISO 37101 (Sustainable Communities Management system). Several municipalities have successfully implemented both schemes (ISO quality management systems and eea) simultaneously.

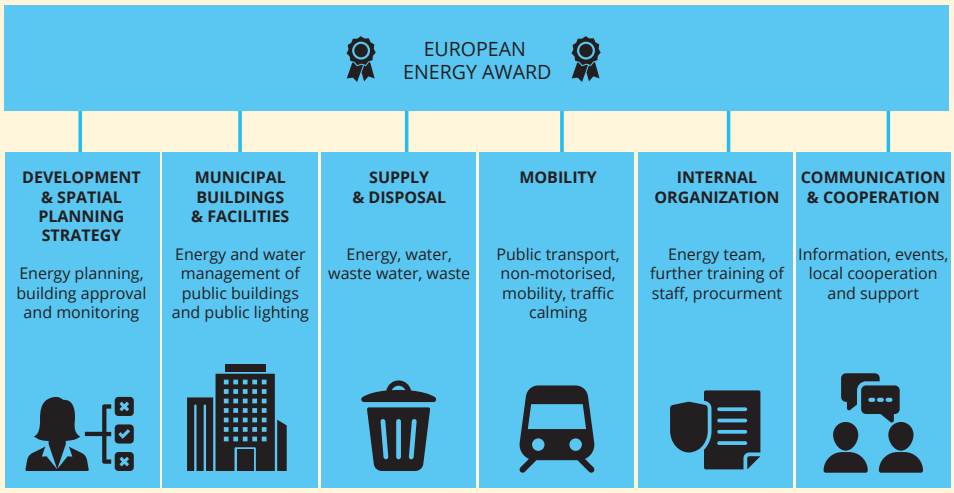


Figure 5-4. The main activities of the municipality in the field of energy and climate protection under the eea system

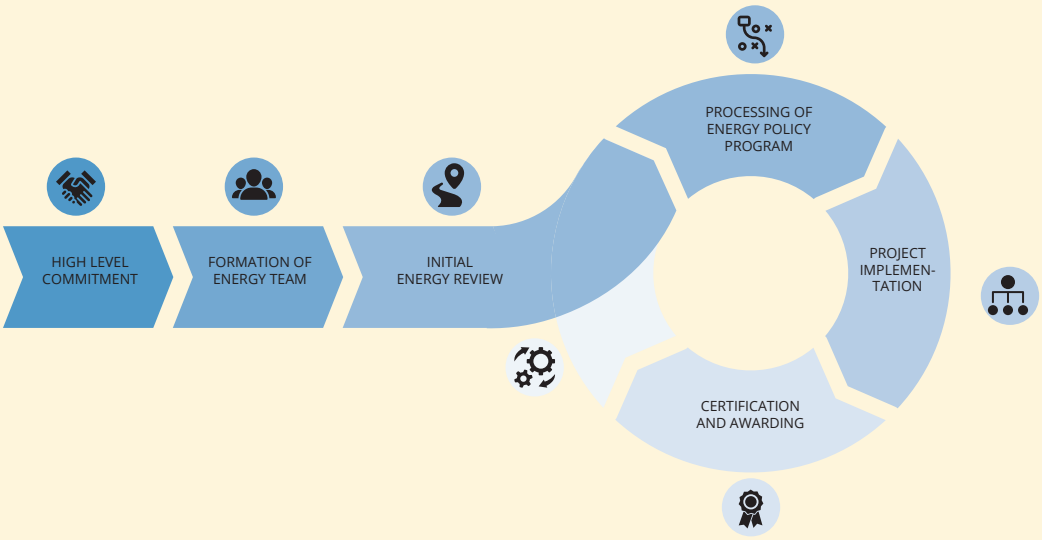


Figure 5-5 The step-by-step process in the eea

Before implementation, eea supports cities in defining their baseline from an initial review conducted by certified external experts/advisors. Based on this review, the potential for improvement can be identified. This helps the city administration to set ambitious but realistic targets and prioritise the actions. eea ensures, through external and certified auditors, a regular evaluation of the improvement, with possibly a certificate awarded when the targets are met. eea is thus a management system with certification principle, based on regular audits and sets of KPIs common to all cities.

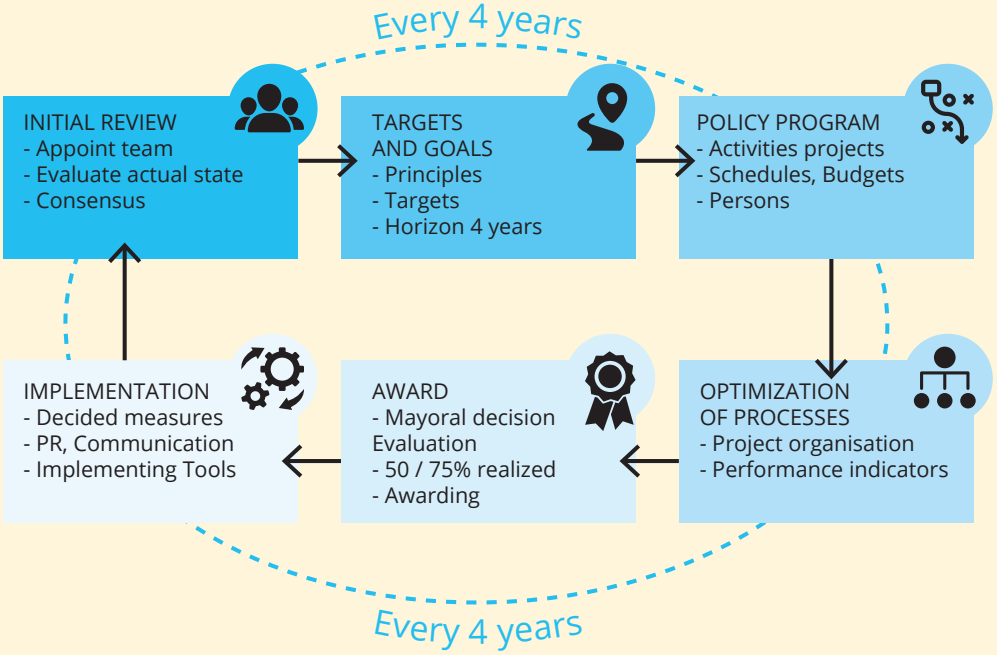


Figure 5-6 The eea recipe: Plan-Do-Check-Act-and (European Energy Award, International Office)

ALAIN JUPPÉ, Former Prime Minister of France
President of the Greater Bordeaux area, Mayor of Bordeaux

"The European Energy Award is a methodological support tool designed to enhance and bring about recognition of the quality of the climate and energy policy that we are conducting in our territories. Our efforts are real and respond to the climate challenges of tomorrow. The continuous improvement process inherent to the European Energy Award has led us to go even further to build with all the local actors a territory resolutely directed towards the energy transition."

MARIE-PIERRE GRAMAGLIA, Principality of Monaco
Minister of Public Works, the Environment and Urban Development

"The eea is a tool that incentivizes action. It assisted the government in giving more prominence to its commitments toward its climate policies."

WHY? There are several reasons why this frequent joint analysis of monitoring outcomes is important. Foremost, the methods and solutions chosen earlier might not perform as expected. It is **only through regular analysis that possible problems can be detected sufficiently early** to avoid irreversible or difficult situations, when it is often quite costly or complicated to make the necessary repairs or adjustments. Frequent analysis of monitoring information thus avoids the need for substantial extra human and financial resources. Similarly, circumstances might have changed compared to the start of the project or action plan, for example due to technological breakthroughs, new regulations and legislation, or political changes.

TO DO 5: EXPLORE HOW TO SOLVE POSSIBLE PROBLEMS AND IDENTIFY WHICH ADJUSTMENTS ARE NEEDED

in order to improve the project. Discuss these with internal and external stakeholders in the quadruple helix

The last TO DO for the **CHECK** stage is to explore how observed or foreseen problems might be solved. The team must identify which adjustments are needed to improve the project. Successively, these **possible adjustments should be widely discussed with all internal and external stakeholders** in the quadruple helix. Such a communication and dialogues with all stakeholders concerned with the project, while staying focused on the agreed targets, provide the best approach to finding the best and most efficient corrective action(s) while maintaining the engagement of all stakeholders.

EXAMPLE: SMART HOMES IN BRISTOL

As part of the SCC-01 lighthouse project in Bristol, monitoring information will soon give clues about if and how changes in energy demand can be brought about by using a remote energy management system to shift energy use in peak times, and by monetary and energy savings flowing from upgrading low-rated home appliances. Smart washing machines, tumble dryers and dishwashers have been installed into 152 households in Ashley, Easton and Lawrence Hill. The white goods are connected to smart home monitoring and control equipment that allow the households to fully utilise the benefits of the smart appliances. The monitoring equipment will also provide data to help us research how energy is used by households and how it could be saved in the future, as well as allowing our energy management system to shift the use of the appliances at peak times. REPLICATE funding is available for 240 homeowners living in Ashley, Easton and Lawrence Hill to install loft and cavity wall insulation, a new boiler and heating controls or solar panels to your home. Underpinning this, it is vital to incorporate community engagement to ensure the buy in and understanding of the citizens and communities utilising the technology (City of Bristol, 2019; REPLICATE 2019).

Figure 5-7 Smart homes in Bristol. Source: City of Bristol (2019)

Figure 5-8 Just opened E-mobility station Westkreuz. Source: SmarterTogether (2019e).

EXAMPLE: MONITORING OF USAGE AND ACCEPTANCE OF E-MOBILITY STATIONS

Within the Smarter Together project scope eight multimodal e-mobility stations were built within the project area of Neuaubing-Westkreuz and Freiham. In order to meet different needs, the mobility stations connect different offers for individual mobility: rental bikes, e-bikes, e-tricycles (all MVG), e-car sharing (STATTAUTO) as well as charging stations for electric vehicles, supplying 100% green electricity (SWM). A digital information pillar displays all available mobility options in the area – including easy access to the offered local services and public transport as well as map services. Additionally, the mobility stations offer free wi-fi.

Two mobility stations have also been equipped with so called “district sharing boxes”. These boxes make delivery, shopping and sharing possible on a 24/7 basis. Each set of boxes include compartments of different temperatures (cooling, refrigerated or at a constant ambient temperature) for different needs. The boxes can be used by local or online businesses as well as privately by the citizens to exchange objects such as tools.

In the coming months the usage and acceptance of the mobility stations will be monitored closely, and the City of Munich will learn from this data if and how they can be improved. Ultimate goal is for them to be a real contribution to a significant reduction of the number of private cars in the area and adding to the electrification of related transport means (SmarterTogether, 2019e).

WHY? To keep the project successful on track, information from monitoring must be interpreted. If the results of the action plan or project are less than expected, the so-called non-conformities, the team has to **explore how the results can be improved by corrective actions**. These exchanges must take place with a wider group of stakeholders, as the identified adjustments can have an impact on other parts of the action plan or project, as well as on other projects. Furthermore, it should be said that monitoring of the corrective actions can contribute to future scaling up and replication programmes, by concentrating on what works and avoiding what doesn't within the current context. This is especially beneficial when different project teams will coordinate the scaling-up and replication programmes.

5.4 Inspiration

Establishing a baseline for developing site-specific solutions

How to refine the local energy Master Plans or SEAPs by developing site-specific solutions? Within the SINFONIA project, a method for elaborating the urban energy Master Plans or SEAPs, has been developed (SINFONIA, 2016). Each city is a unique combination of economic, social, environmental, and institutional conditions, what results in various needs, priorities, and capacities for Smart Energy City development, while the transition to a Smart Energy City is a complex process involving many different stakeholders. The method helps to construct a baseline of local knowledge that can support the definition of site-specific innovative solutions and stimulates the adoption of best practices when elaborating the local energy Master Plans. The development towards a Smart Energy City is a site-specific, continuous transition towards sustainability, self-sufficiency and resilience of energy systems. Accessibility, affordability and adequacy of energy services must be ensured through optimised integration of energy conservation, energy efficiency and local renewable energy sources.

The methodology features a combination of energy technologies with information and communication technologies, which enables integration of multiple domains and enforces collaboration of multiple stakeholders, while ensuring sustainability of its measures. The elaboration of local energy Master Plans brings with it a continuous flow of information among the relevant stakeholders, and between them and the city administration. The setup of such a "information sharing system" can be considered as one of the preconditions for a successful implementation of a Smart Energy City transition. Bolzano and Innsbruck have been chosen as demo cases for testing the proposed method.

The aim of the "Refinement of the local Master Plans" in these pilot cities is twofold. Firstly, as the masterplans of the two cities were established in 2009 respectively 2007, it is essential to gather detailed inventories of current energy consumptions - based on 2014/2015 data - in order to have an up to date baseline upon which to evaluate the improvements of the SINFONIA demonstration measures. Secondly, it is essential also to determine the influence of the demonstration measures on the chosen project goals in the view of the transition to Smart Energy Cities. For this reason, a structure and a list of variables, as well as the sources available to gather the information, are given. To obtain a sound baseline, the following data should be considered in the calculation of the baseline and monitoring of progress:

1. Energy consumption data
2. Energy production data
3. Boundaries and general context data
4. System components data
5. Framework data
6. Data for monitoring
7. Meteorological data
8. Data about renewable energy potential production
9. Data about energy saving potential#
10. Additional data on the evolution of framework conditions

Of course, these are the ideal input data in theory for calculating a baseline in urban environment or, as in the demo cities, at district level. However, the process highlights that access to the data is a very complex task. For example, in Bolzano and Innsbruck the experience was that some of the data were simply unavailable and some could not be retrieved due to data protection laws. Therefore, the theoretically perfect baseline is hard to achieve. This does not mean that the results are unreliable, but rather that it is hard to obtain all the data needed in a short time-frame. The method is structured and explained in such a way that Early Adopter Cities and all European cities can understand and replicate it to create baselines which help to promote the transition to smart energy urban environments and are able to stimulate the adoption of site-specific best practices.

6 STAGE 6: MAKING AMENDMENTS

6.1 Background

The **ACT** stage is the stage **where corrective actions are decided upon and implemented to meet the final targets**, following up on the **CHECK** stage where progress was checked against expected targets.

Depending upon the outcomes of the evaluation, corrective actions and continuous improvement might have to be organised, especially when **performance gaps** are observed. Due to the complex nature of progressing towards sustainable low carbon cities, it is likely that uncertainties will persist, or surprises occur, and the output may not always fit what was planned. Therefore, it is crucial that the progress of urban smart and sustainable development should be reviewed on a regular basis and **corrective and preventive measures should be adopted wherever applicable**. It is recommended that cities adopt an evaluation and continuous improvement management cycle (Plan-Do-Check-Act, PDCA) to perform those tasks effectively over time.

The iterative, four-stage approach of the PDCA process aims to continually improve the action plans or projects to meet the expected final objectives. The PDCA cycle helps to solve problems and implement solutions in a rigorous, methodical way. Following these four stages will ensure getting the highest quality results and achieving the expected/planned objectives. The method for developing and implementing integrated plans as proposed in this roadmap, is partly based on the PDCA cycle, from the ISO High level management system principles (ISO, 2019).

At this **ACT** stage, that follows the **CHECK** stage where the (intermediate) results of projects or action plans are analysed against the expectations defined in the **PLAN** stage, corrective actions are defined, agreed and implemented if the **CHECK** stage shows that the expected targets would not be met. In that case, it will be necessary to repeat this iterative process as long as the results are not in line with the expectations or earlier defined targets. This might even imply adjustments to the plan and going back to specific implementation steps in the **DO** stage.

6.2 Checklist for the ACT stage

As mentioned earlier, the **ACT** stage **makes the actual changes during project implementation to ensure that the targets are met**, following up on suggestions for improvement made earlier in the **CHECK** stage.

The **main question** at this stage is: "***How to adjust the action plan and/or projects in order to meet its/their eventual targets?***".

The first TO DO is relate suggestions for improvements and amendments to the final objectives and overall ambitions of the city administration and other relevant stakeholders in the quadruple helix. Sometimes, this might entail a review of the earlier established targets, which are supposed to reflect these final objectives and overall ambitions. After that, the city administration and the key stakeholders must select and agree upon the most appropriate and feasible improvements and amendments, based on the recommendations of the implementation team, and with wider consultation of other partners within the quadruple helix. When the agreed improvements and amendments have been implemented, the project team will regularly report on them to the city administration and stakeholders. Importantly, critical success factors for the project or action plan in relation to its context should be identified, as this is of key importance for scaling up and replication in future. And lastly, specific operations will need adaptation and fine-tuning based on evaluation, with the help of a permanent improvement loop.

Figure 6-1 Checklist of TO DO's for the ACT stage

STAGE 6: ACT

Question:

How to adjust the action plan and/or projects in order to meet its eventual targets?

TO DO 1: RELATE SUGGESTIONS FOR IMPROVEMENTS AND AMENDMENTS TO THE GOALS AND AMBITIONS

of the city administration and other relevant stakeholders in the quadruple helix

TO DO 2: SELECT AND AGREE UPON THE MOST SUITABLE IMPROVEMENTS AND AMENDMENTS

based on the recommendations of the implementation team, in consultation with the quadruple helix

TO DO 3: IMPLEMENT PROPOSED CHANGES

by city administration and relevant stakeholders

TO DO 4: REGULAR REPORTING

by the project team to the city management team

TO DO 5: IDENTIFY CRITICAL SUCCESS FACTORS

for the project related to the context of the project

TO DO 6: ADAPTATION AND FINE-TUNING

of specific operations based on evaluation in permanent improvement loop

Tools & standards

TOOLS:

- traditional project management tools, such as contingency plans for risks

STANDARDS:

- ISO 37101 Quality Management Systems Approach
- ISO 37104 series

Output:

amendments and improvements realised, lessons learned

Useful **tools** for the **ACT** stage consist mainly of traditional project management tools, such as contingency plans for risks. Important **standards** for this stage are: ISO 37101 Quality Management Systems Approach, and ISO 37104 series.

Following the checklist of TO DO's will result in **amendments and improvements being realised**, and **lessons learned for future action plans or projects**, not only within the city's jurisdiction, but also in other cities.

TO DO 1: RELATE SUGGESTIONS FOR IMPROVEMENTS AND AMENDMENTS TO THE GOALS AND AMBITIONS

of the city administration and other relevant stakeholders in the quadruple helix

6.3 How?

The last TO DO of the **CHECK** stage explored potential solutions to the problem, or non-conformity, observed. Here, these **suggestions for solving the problem are interpreted, and related to the final objectives and overall ambitions of the city administration and other relevant stakeholders** in the quadruple helix. Suggestions the project team has in mind, might have consequences for chosen methods or technologies, role and task divisions, mandates and responsibilities, and these should be realised and dealt with. This means that the impact of proposed changes on other projects must be taken into account.

Basically, there are three ways to improve:

- To change the actions or measures when the targets are not met;
- To adjust the targets because they were not realistic;
- In case the "design" of the action plan or project contained some flaws, it is recommended to go back to the PLAN stage and redesign parts of the action plan or project.

Many smart city and low energy district projects and action plans need to make amendments or work with a plan B due to their high ambitions, the complex urban setting and their sometimes rather experimental character. When these experiences and lessons learned are shared, for example, on a platform as SCIS, a solid learning environment is created which benefits other cities.

WHY? This TO DO ensures that the **suggestions for improvements, adjustments and amendments are in line with the higher aims** of the project or action plan as laid down in the objectives during the **VISION** stage. It also ensures that good collaboration between implementation team and the wider group of stakeholders is continued.

TO DO 2: SELECT AND AGREE UPON THE MOST SUITABLE IMPROVEMENTS AND AMENDMENTS

based on the recommendations of the implementation team, in consultation with the quadruple helix

Following, the most appropriate and effective **suggestions for improvements, adjustments and amendments must be selected and agreed upon**. Usually, this selection is based on short-listed recommendations of the implementation team, in consultation with all other relevant partners in the quadruple helix. However, before making a selection, the extent and seriousness of the problem must be clear. For this reason, the implementation team must check the cause(s) of the non-conformity, in order that it does not reoccur or resurface elsewhere, for example in other projects. This should be done by reviewing the non-conformity, determining its cause(s), and check if similar non-conformities exist, or could potentially occur.

WHY? All stakeholders need to agree on the proposed improvements, adjustments and amendments to ensure they are adequately implemented. Besides, the extent of the problem or non-conformity must be clear to determine how it can be solved in the best way.

TO DO 3: IMPLEMENT PROPOSED CHANGES

by city administration and relevant stakeholders

Evidently, the next TO DO is **to implement the action(s) needed**, as seems fit. The city administration or the respective stakeholder responsible for this, ensures the mitigating or corrective measure is taken. Parts of the **DO** stage might be applicable here as well, as this TO DO is basically a "mini" implementation. For example, changes in the team or role division, re-allocation of resources, adjustment of the monitoring process, and knowledge sharing through the platform.

WHY? The **observed problem(s) will not be solved** if the mitigating or corrective actions are not implemented.

TO DO 4: REGULAR REPORTING

by the project team to the city management team

Subsequently, the effectiveness of any corrective action taken must be reviewed on a regular basis. For that reason, the next TO DO is that the **project or action plan implementation team reports regularly to the city management team about this**, and if needed, to the most relevant other stakeholders. To do this properly, the team must keep documented information as evidence of the nature of the non-conformities and any subsequent actions taken, and the results of any corrective action. This documentation should provide information on topics such as information on conformity, details of the non-conformity, corrective and preventive measures taken, and consequences for targets and indicator values.

WHY? This TO DO **prevents new problems being created** when the effectiveness of the implemented improvements, adjustments or amendments is unclear.

TO DO 5: IDENTIFY CRITICAL SUCCESS FACTORS

for the project related to the context of the project

To prepare for further replication and scaling up of successfully implemented actions in the future, for example, within the cities' territory, the next TO DO is to identify the critical success factors for the project or action plan related to its context. Based on this information, changes can be made to the original action plan or project for smart sustainable development in communities in future, if necessary.

EXAMPLE: PROCESS LEARNING AS ONE OF THE MOST CRITICAL SUCCESS FACTORS OF SCC-01 PROJECTS

Recently, Triangulum, one of the first SCC-01 projects, hosted the Triangulum Monitoring and Assessment Exchange meeting, which was attended by four other SCC-01 projects. At this meeting, process learning was identified by Lighthouse City partners as the most important and lasting outcome of their participation in SCC-01 projects. Due to their experiences, the involved cities profoundly changed the ways in which they work. Most prominently, the city administrations learned how to form deeper partnerships across public, private, academic and charity sectors. Apart from that, the city administrations changed their structures and processes, for instance by establishing new entities or data exchange platforms to facilitate both cross-domain and quadruple helix collaboration, or by development of new competences to improve procedures, for instance with respect to procurement. And lastly, city administrations learned how to do more effective stakeholder management and use more robust methodologies for capturing social impacts. It is thought that novel KPIs and value capture techniques for process learning should be identified or developed, which reflect these crucial "soft" impacts much better. What is more, these experienced Lighthouse Cities believe that the uptake of smart city solutions can be vastly accelerated if city administrations know in advance, how they should prepare their processes and structures for adoption of smart city solutions, both internally and externally (Evans, 2019).

(Photo credits: Shutterstock)

WHY? By checking this TO DO, **valuable experiences and lessons learned are not lost**, and the **PLAN** stage for the new projects or action plans can be done more efficiently, because it builds upon earlier experiences. Again, this is closely related to further development of the SCIS and EIP-SCC Marketplace as platforms for urban innovation and transition, where experiences are consolidated and shared, and the contribution of individual projects and action plans to creating a learning environment (SCIS, 2019).

TO DO 6: ADAPTATION AND FINE-TUNING

of specific operations based on evaluation in permanent improvement loop

The last TO DO at the **ACT** stage is the **continuous adaptation and fine-tuning of specific operations** based on evaluation. This permanent improvement loop ensures that the implemented actions stay tuned towards new political, societal or technological developments.

WHY? For several reasons, small adjustments might be needed during the implementation phase of the project. The principle of a permanent improvement loop guarantees that eventually the agreed targets are met in the best way.

Photo credits: Erik Børseth, Synlig Design

7 STAGE 7: INCREASING THE IMPACT BEYOND THE PROJECT

7.1 Background

As mentioned in the introduction, the stage of **REPLICATE & SCALE UP** shapes the right environment for repeating the project(s) or action plan(s) at other locations, both within and outside the city's jurisdiction, and for applying the demonstrated solutions on a wider scale through bundling of the demand in the market. **Sharing of experiences and best practices is key to a further uptake and acceleration of the market for smart city solutions**, as success stories build trust and help to move from consultation to agreement. How can an environment be shaped that leads to further innovations beyond the smart city or low energy district project itself, creating a pipeline of projects? How can the uptake of successful smart city solutions be fostered, and the market for these solutions accelerated? The stage of **REPLICATE & SCALE UP** plays a central role in this.

Planning for replication and scaling up

Many smart city projects demonstrate novel and innovative approaches and might be of an experimental nature. Urban living labs, testbeds, pilots, demonstration and lighthouse projects may use different methods, but all have in common that they deploy an evidence-based approach for developing results, processes, solutions and insights within a specific territorial context. These contexts are highly different from each other, as historical, spatial, political, social and economic characteristics of urban areas vary greatly, not only between cities, but also between districts and even neighbourhoods. If outcomes of such a demonstration or pilot are largely transferable to other locations and situations, the project will have a wider and more profound impact and will foster urban transitions towards sustainability and resilience.

Thinking about replication and upscaling actions already during preparation of the plan, is very important for several reasons:

- *Including specific actions preparing the ground for scaling up and replication* after the project's life into the implementation plan, can help to generate more impact beyond the project's current scope, and facilitate urban transitions. 'Simple', traditional market roll-outs, aiming at widening the scale of distribution of certain technical products or solutions, do not suffice here due to the complexity of bringing about urban change.
- *Territorial characteristics and specific contexts of demonstrations or pilots*, make it so that the results, solutions, experiences, processes and knowledge generated in these projects, cannot simply be "copy-and-pasted" into another place as the characteristics and contexts are different there. For that reason, the influence of territorial and context differences on the outcomes of the demonstration or pilot has to be understood, and special attention has to be paid to them, when solutions are implemented in other places and in other situations (Akrich et al., 2002);
- By analysing very early in the process which situations and solutions have a high potential for replication and upscaling, *vital information becomes available that might lead to different choices made when planning the project(s) in detail*. Areas where intended demonstrations can be repeated, should be identified beforehand;
- It gives the chance *to anticipate specific local constraints on upscaling before the project is implemented*, for example based on experiences with previous innovation projects. The question of how these constraints may be overcome can be made a part of the learning environment of the project (Dijk et al., 2018);
- Specific *results of demonstrations might have significant repercussions for value chains in current business models*, for example those of some participating stakeholders.

Different ways of increasing impact after the end of the demonstration or pilot

The stage of **REPLICATE & SCALE UP** covers various actions and processes. Often certain terms are used when talking about enhancing the impact of experiments after they are finished, and the differences between them is in many cases not entirely clear. Below these terms are briefly explained, using the report 'Organising Smart City Projects – Lessons from Amsterdam' (Winden, 2016) and the experiences in JPI UE project SmarterLabs, which developed and tested a novel approach to scaling up in smart mobility living lab experiments.

Roll-Out: This term describes a rather simple commercialisation and market entry of a product, solution or technology after the demonstration or pilot. This can be a market roll-out, when an experimental solution is brought to the market, a city roll-out when the experimental solution is implementation across the city; or an organisational roll-out: The technology or solution developed in the demonstration or pilot is not context-sensitive and does not need to be adapted before rolling out. In most cases, the roll-out is managed by the organisation that initiated the experiment.

Expansion or growth: In this case, the demonstration or pilot is being extended in the geographical area covered, or by adding more partners and possibly more capabilities. Simple roll-out is not an option here as there is limited control over the process and the involved organisations are independent.

Scaling up: The key difference between scaling-up and roll-out is that in the case of roll-out the societal context does not change, whereas in the case of upscaling wider application of the innovation also requires or goes hand-in-hand with changes in the societal (or 'socio-institutional') context. Hence, scaling up is not just about wider adoption of an innovation, but entails changes in various other components such as stakeholder perspectives, capabilities, business models (i.e. informal institutions), and regulation (i.e. formal institutions), in addition to the technological hardware (i.e. artefacts or infrastructure etc.). To give an example, for a case such as sustainable choices for transport modes in the city, scaling up in an urban context requires all these different components to achieve innovation. It concerns not only the technological component (vehicles, smart apps, chip cards etc.), but also social practices (e.g., travel routines) and governance practices (e.g. local mobility policies and parking regulations, contract with current mobility and parking operators, and so forth). This means that scaling up of (successful) mobility innovations from urban experiments is not a matter of simply 'rolling out' across the city but is tied up with processes of institutional change: new ways of doing things in existing institutions that are transformed by this. Scaling up is also related to knowledge transfer in the sense that through knowledge exchange between different experiments, new knowledge developed in a Living Lab can benefit both from local learning processes and from experiments in other places, provided they are close in terms of content and topic. Effective living labs anticipate beforehand how to scale up their impact beyond their specific location and group of participants in the experiment.

Replication: Replicating demonstrations or pilots means that the same projects are done elsewhere. This implies that different organisations, other territories and/or other cities are involved. Replication requires taking into account the complexity of the new context in terms of geographical, legal, and organisational aspects. Therefore, the solution, technology or process needs to be adapted. Replication is complicated mainly because anchoring the original project in a new context requires active translation to this new context which supports the knowledge transfer mechanisms.

7.2 Checklist for the REPLICATE & SCALE UP stage

This stage organises the preconditions and support for enlarging and repeating the demonstration or pilot(s) both within the city's territory and jurisdiction, and at other locations. This might require for example the adjustment of specific regulatory frameworks such as EU competition rules (see Vandevyvere, 2018), formalisation of collaboration within the local ecosystem in the form of an association (e.g. Brainport Eindhoven), or explanation of best practices to other stakeholders thus far not engaged in the demonstration or pilot, but with a comparable role (City of Vienna, 2019).

Having a learning environment in place for other cities and stakeholders, which clearly shows the ins and outs and achieved impact of all demonstrated measures, is crucial for the exchange of knowledge and experiences. A benchmark of successful case studies greatly helps other cities to improve their smart and sustainable development by using vital information from these best practices for preparation of their own plans. Repositories such as the Smart City Information System (SCIS) are an indispensable part of such a learning environment. In the end, this will lead to a pipeline of projects, an acceleration of the hitherto fragmented market for smart city solutions and urban transition toward low carbon cities.

The main **questions at this stage** are: "**Which organisational and financial models sustain the project(s)' or action plan's upscaling and replication, and which innovative solutions can be adjusted and applied in other places and cities?**" Other, related, questions are how these innovative solutions can contribute to improving the (master) plans of cities that want to apply them in their own jurisdictions, such as fellow cities or cities participating in the Covenant of Mayors.

Answering these questions requires **various actions and TO DO's**. Foremost, communication and education by sharing of the results of a demonstration, pilot, living lab, testbed or regular project. Furthermore, a suitable business model has to be defined, what will guarantee the project's sustainability and maintenance in future. In addition, a plan is needed for how to continue and organise this type of collaboration between city and relevant stakeholders, such as civil society, industry and research, in the future. If needed, the initial plan and project needs to be updated and adjusted to changes, for example in society, technology, policies, and legal frameworks. To support replication and upscaling, the suitability of demonstrated solutions in different locations and contexts needs to be investigated. And finally, the start of these new projects in the same or other cities will make the circle round.

Important **tools** here are methods for drafting business model plans, regular financial evaluation tools producing key financial parameters such as ROI, collection of case studies from smart cities projects, tailored workshops, networking, peer-to-peer meetings, site visits of successful projects, involvement of city networks, industry platforms and branch organisations for the sharing of results, and key repositories as the Smart City Information System. Currently, there are not specific standards available for replication or scaling up.

Output of the stage of upscaling and replication consists of having the right preconditions for further market uptake in place, an improved learning environment between cities through knowledge exchange and uploading of vital project information in repositories, and eventually an acceleration of the market for smart city and low energy district solutions, eventually leading to an acceleration of urban transitions towards sustainability.

Figure 7.1 Checklist of TO DO's for the REPLICATE & SCALE-UP stage

STAGE 7: REPLICATE & SCALE UP

Question:

Which organisational and financial models sustain the projects' upscaling, and which parts of the project can be replicated in other places?

TO DO 1: COMMUNICATE AND EDUCATE

by sharing results through repositories and city networks, and by capacity building

TO DO2: DEFINE THE BUSINESS MODEL

in terms of durability and resilience in future, and financial resources for scaling up

TO DO 3: DEVELOP A PLAN FOR WIDER COLLABORATION

with industry, ICT companies, solution providers, citizens, local businesses and research after the demonstration or implementation

TO DO 4: PERFORM A VIABILITY ASSESSMENT

of applied methods and solutions for other projects and contexts, and do a risk assessment of key success factors

TO DO 5: ADJUST APPLIED METHODS AND TECHNOLOGIES

towards local situation and conditions, and to foreseeable changes in future

TO DO 6: CONSOLIDATE A PIPELINE OF NEW PROJECTS

in other cities with other contexts and local specificities

Tools & standards

TOOLS:

- Tools for drafting business model plans
- regular financial evaluation tools (CAPEX, OPEX, ROI, etc.)
- collection of case studies from smart city and low energy district projects
- tailored workshops
- networking
- site visits
- peer-to-peer meetings
- involvement of city networks
- industry platforms and branche organisations
- repositories as Smart City Information System

Output:

Right preconditions for further market uptake created, a learning environment for cities in place, an accelerating market for smart city and low energy district solutions

TO DO 1: COMMUNICATE AND EDUCATE

by sharing results through repositories and city networks, and by capacity building

7.3 How?

Foremost, communication and dissemination of the experiences, not only of successes but also of barriers and failures, are essential for creating the learning environment that allows a wider community to benefit from the outcomes of the demonstration or pilot. Therefore, the **sharing of results** is an important TO DO that cannot be underestimated. Based on these outcomes, other cities and stakeholders can set up new projects, adapted to their local situations and contexts. The city hosting the original demonstration or pilot, can support such a process by **peer-to-peer collaboration with the other city**, while city networks as Eurocities and ICLEI can help to disseminate the results in a wider group of cities.

EXAMPLE: STORYTELLING AS A MEAN TO ACCELERATE IMPACT

In URB@EXP, funded by JPI UE, guidelines were developed to facilitate the impact of urban labs. For people and organisations participating it is essential to show the achievements and tangible outcomes of the participatory work in the project. The JPI Urban Europe URB@EXP project found out that “it is crucial that lab practitioners disseminate and anchor the knowledge they obtain about thematic and organisational topics through internal and external storytelling, as a means of sharing and interpreting the experiences gained.” Furthermore, the project underlines that storytelling will help with aligning the participants and that it is a very useful tool to communicate complex information. For external communication purposes, storytelling can be used to disseminate the key results using various media: writing, video, animations and so forth. Storytelling is a crucial practice to ensure the connection between the participants in a project and to create a sustainable community and, on external communication, storytelling of achievements, barriers and bottlenecks within an experimental project can be used for disseminating results, inspiring and therewith, scaling up and replication (Scholl et al., 2019).

EXAMPLE: INTERNAL AND EXTERNAL CAPACITY BUILDING FOR COPING WITH COMPLEX PROBLEMS

Education, training and the distribution or sharing of knowledge has been found to be essential in experimental projects, according to JPI UE project URB@EXP (Scholl et al., 2017). Internally, the project partners need to strengthen their capacities with new social and personal skills in order to co-design, implement, manage, communicate, mediate, negotiate, facilitate, resolve conflicts and learn from their activities. Externally, public institutions and administrative structure can learn how to manage the interests of various stakeholders in complex relationships. The capacity building involves the development of partnerships, inspiration, exchange of skills and knowledge, networking and sharing information as well as innovative methodologies.

EXAMPLE: QUOTES FROM VIENNA EXPRESSING POSITIVE VIEWS ON THE LIGHTHOUSE PROJECT

Informal communication about the results of the project or action plan is very important for potential replication and upscaling. The quotes below make clear that the results are highly valued.

Michael Castellitz (BWSG, a Limited-Profit Housing Association):
"An important aspect for us is social justice and we are proud to be able to provide ecologically sustainable mobility to our residents in the Hauffgasse (housing complex)."

"The BWSG has launched a pilot project with the e-car sharing Hauffgasse, which has not yet taken place in this form in non-profit housing. We even like it so much that we consider implementing the project in other projects."

Markus Zagermann (resident/user/active group member):
"The active group is really promoting the neighbourhood, the sense of togetherness."

Nathalie Gmeindl (resident/user/active group member):
"It is a nice feeling that you know a few people right away."

Gerhard (resident/user/active group member):
"I've been living in this housing estate since 1982 and now with this refurbishment and the possibility of having electric mobility available to lend, I thought, I'll take a look at that, that sounds good."

"This is really fun and is also green, impossible to have it greener."

EXAMPLE: TRANSFER OF KNOWLEDGE FROM DEMONSTRATOR CITIES TO CELSIUS MEMBER CITIES

CELSIUS worked very successfully with knowledge transfer in several ways:

- The online wiki-based CELSIUS Toolbox gathered information from the project's demonstrators, as well as contributions and research from other actors in the network, including other EU-projects, academic institutions, and industry actors. The wiki format means that the accumulated knowledge is expanded, linked, and refined. It also allows users to hone in on the particular topic they want information on. As the needs and challenges of cities differ, the same information will not be relevant for everyone. The wiki-format means that city representatives can search for what they need, and even have the opportunity to report back by contributing their own results to the wiki;
- Dedicated workshops and conferences – these have often focused on a specific topic, related to the demonstrators or other expertise within the project;
- Webinars on specific topics. Some have focused on results from the demonstrators while others have presented solutions based on needs that CELSIUS Member (follower) Cities have identified. These are open to all Member Cities and other members of the network, recorded, and put up on the CELSIUS Toolbox wiki afterwards;
- Uploading of CELSIUS monitoring data to the SCIS platform;
- Participation in a District Heating and Cooling network with many different kinds of stakeholders involved. This allows for needs-based and spontaneous knowledge transfer and for concrete further steps to be taken outside of formalized CELSIUS activities (e.g. some cities in need of companies or expertise might learn of where this is and then establish contracts outside of the CELSIUS activities).

Supporting CELSIUS Member Cities involved a combination of categorisation/ generalisation and tailored solutions based on an ear-to-the-ground approach. Different contexts fostered expertise in certain areas, and it required imagination to be able to use knowledge in different contexts. Peer-to-peer learning with discussions where both parts need to learn, proved to be successful, although time-consuming while it needs to be combined with support at system level.

ETIENNE VIGNALI, Project Manager Lyon-Confluence: "Thanks to the Smarter Together project… we have made important progress for tackling energy challenges in the Lyon-Confluence urban project » … we have strongly increased the production and distribution of renewable energies, the energy renovation of buildings, the development of electric mobility solutions and the data management for improving the environmental performance the Lyon-Confluence urban project."

TO DO2: DEFINE THE BUSINESS MODEL

in terms of durability and resilience in future, and financial resources for scaling up

Within the city that hosted the project, usually successful implementation is followed up by creating the right preconditions for **repeating the project within the city administrations' jurisdiction**. Therefore, the next TO DO entails that the business model in terms of durability and resilience must be defined, and financial resources for expansion, scaling up or replication ensured.

EXAMPLE: SUSTAINING THE INNOVATIVE PROJECT

Once the end of urban living labs and other experimental projects comes in sight, usually the question arises what will happen with the network, experiences and knowledge created in the project and how to continue. This applies to the aim of continuing the experimentation; using the knowledge and experiences that have been generated in the lab rather than scaling a certain solution. URB@EXP has defined several scenarios for the future of urban labs once the initial project ends (Scholl et al., 2017):

- *Continuation of the lab:* Continuing with the original operation without changing the model or the organisational structure;
- *Expansion of the lab:* Increase in people involved in the urban lab and financial resources;
- *Replication of the lab:* replicating the lab principles and working procedures in a completely different institutional setting: different municipal departments, stakeholders, urban actors;
- *Integration of the lab:* Embedding the principles, practices and knowledge applied and generated in the lab into urban governance structures. This implies a permanent behavioural change in the administration of cities.

EXAMPLE: CITIZENS HELP TO SHAPE NEW BUSINESS MODELS FOR E-CAR SHARING IN VIENNA

Smarter Together took advantage of the refurbishment process in Vienna to anchor other innovative actions. Car-sharing e-mobility is a part of the refurbishment process and brings additional value to both the BWSG, a Limited-Profit Housing Association, and the tenants. The close co-operation with the mediation institute (wohnbund:consult) located on the site, provided the human resource base for communication and

motivation. This organisational set up was a clear win-win situation for all involved. The motto was: Change must happen, refurbishment has to be done, let's make it smart. The EU funded project was a good innovation trigger. Credibility was at the core, the EU funding essential for making a first showcase. A professional car-sharing provider was essential in the set up (Caruso). Soon after the initial information phase, a group of highly motivated pioneers among the tenants with quite some technical skills, became involved in the initial project design and choice of the three e-car models that were to be acquired. This group currently also handles the everyday management supporting Caruso, while it provides valuable feedback on and inputs to the implementation phase of the pilot project. The group is also involved in the design of the final business case. All professional stakeholders identified e-car sharing in a Limited-Profit Housing Association as an interesting business case and are developing it further now in other projects (upscaling during the process). An additional result, though not expected at that level beforehand, was the aspect of social integration and local social dynamics triggered through the e-carsharing. The latter appeared to be of a major interest for the Limited-Profit Housing Association (SmarterTogether, 2019d).

Figure 7-2 E-carsharing in Simmering Lighthouse project in Vienna (Source: SmarterTogether 2019d)

WHY? To really support transitions towards sustainability and liveability and to limit risks related to wicked issues, the solutions, innovations and research results have to be grounded in urban contexts and systems. What has been observed in recent years is that technology and solutions have been developed and are available, but that the **experiences and knowledge created in these demonstrations or pilots were not being sufficiently contextualised** to achieve a (regime) change on a larger/broader scale.

One reason is that traditional business models are often not useful for experimental urban sustainable and smart development projects. **Traditional business models might be challenged by new models for urban sustainable development**. Therefore, new business models could work against the interests of long-established businesses. Consumers becoming pro-sumers, can pose a threat to existing, well working business models. For example, business models which allow a decentralised production of energy by individual households, might go against traditional business models such as energy production by coal, atomic energy, and so forth. The interests of organisations benefitting from these traditional models, might not support the uptake and wider distribution of such novel products and processes. At the other hand, the coming int existence of new value chains might lead to new business models.

TO DO 3: DEVELOP A PLAN FOR WIDER COLLABORATION

with industry, ICT companies, solution providers, citizens, local businesses and research after the demonstration or implementation

The next TO DO for this stage, is that a **plan needs to be developed which consolidates wider collaboration** of the city with industry, ICT companies, citizens and local businesses after the demonstration is finished. This could be for example with representative organisations of specific stakeholders, such as housing associations and grassroots initiatives, branch organisations of professionals, or associations of local government.

EXAMPLE: COOPERATING WITH KNOWLEDGE CENTRES AND LIKE-MINDED INITIATIVES

In JPI UE project URB@EXP it appeared that knowledge centres are important actors who have the capacity to facilitate social learning processes and stakeholder engagement. They also help to bring the lessons learned and the knowledge generated in urban labs into decision-making and agenda setting processes. Further, connecting experimental projects with local (grassroots) initiatives and activists can help to implement transformative processes. In addition, networks bringing together governmental institutions, and bottom-up initiatives and local activists, on regional, national and transnational scale, support the exchange of knowledge, lessons learned and consequently enhance the impact of the experimental projects (URB@EXP, 2019).

EXAMPLE: UPSCALING OF INNOVATIVE APPROACHES IN HOLISTIC REFURBISHMENT OF HOUSING AND TENANT'S PARTICIPATION IN OTHER SOCIAL HOUSING BLOCKS IN VIENNA

Holistic approaches to urban renewal are at the heart of energy and resource savings. Vienna's Smarter Together approach is process-oriented and inclusive with respect to all actors. It combines a bottom-up learning and a top-down decision-making process. Crucial is not a specific activity itself, but the learning process, the trust built up and the motivation of all actors including government, Limited Profit Housing Associations and tenants. This approach helps government, housing management, institutions dealing with the dialogue with the tenants as well as tenants themselves, to become and stay motivated and empowering them to make their own respective contribution to climate action. Through interaction, the different actors take over responsibility and are given the tools to make a change. Upscaling of Smarter Together solutions in Vienna is a result of this process and done by the actors on a variety of levels:

- The Limited-Profit Housing Associations (LPHA) integrate knowledge, skills and motivation gained throughout the process, and scale it up through other ways of management within their own enterprises;
- The gained competitiveness becomes a showcase for other LPHA within the Austrian umbrella organisation GBV;
- The City of Vienna as social housing provider integrates new experiences, skills and methods through the implementation of the pilot project. Upscaling is done during the process by including a variety of departments and units;
- Upscaling is especially ensured within the institutions which take part in the project, that are dealing with the dialogue with tenants (private and public);
- A specific way of up-scaling up the projects' results is taking place by integrating skilled project management staff, experienced in the SmarterTogether project, in a strategic position in Vienna Housing (owning 220.000 municipal flats, accommodating 25% of Vienna's population).

The legal framework and desirable innovations are tackled through inclusive project management and process (SmarterTogether, 2019d).

Photo: City of Vienna

EXAMPLE: ADVANCED DECISION SUPPORT FOR SMART GOVERNANCE

Figure 7-3 SmartGov: Advanced Decision Support for Smart Governance (Source: SmartGov, 2019)

SmartGov (2019) aims to create new governance methods and supporting ICT tools that simulate the impact of policies on urban planning in Smart Cities. Furthermore, the project supports two-way communication with large stakeholder groups. 'Smart Cities' provide new ways of designing and managing public services, infrastructures and buildings, sustainable mobility, economic development and social inclusion. However, communication between citizens and urban policymakers is hardly bi-directional, partly because citizens' social media feeds and useful open data sets are underutilised. New modelling and visualisation tools were developed that effectively incorporated linked open data and social media into Fuzzy Cognitive Maps, for discussing policy scenarios between citizens and governments. The tools have been tested in four cities: Limassol, Quart de Poblet, Vienna and Amsterdam.

EXAMPLE: LEARNING PROCESSES AND CHANGES IN BEHAVIOUR FOR REDUCED ENERGY CONSUMPTION

Although tremendous progress has been made in technological innovations for saving energy, the average energy consumption per household in Europe has increased in the last few years. The primary goal of CODALoop is to achieve positive changes in behaviour of residents (CODALoop, 2019). To achieve this goal, urban living labs in Amsterdam, Graz and Istanbul have been set up to gain an in-depth understanding of

the learning processes and behavioural changes needed to reduce energy consumption in cities. An online platform has been developed which allows users to monitor the implications of their behaviour (in housing, mobility, consumption and recreation) on the energy consumption compared to the average consumption in the district. The diagram below illustrates the learning and adaptation loops which are established in the urban living labs: Generating 'Data to Individual', 'Individual to Community' and 'Community to Policy' learning and adaptation feedback loops through designing and testing support software for data-sharing and social interaction.

By using a mix of co-creation methods and involving residents in three urban living labs the project will develop a conceptual understanding of data-driven feedback loops. These enable learning and behavioural change in energy choices, a marketable software platform for data-sharing, and social interaction about energy use and policy innovations for energy transition.

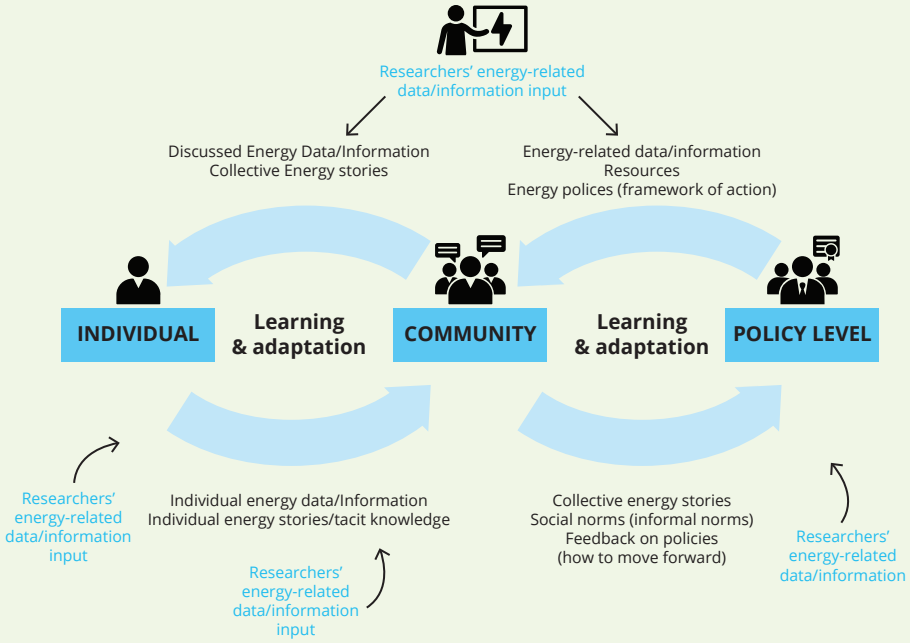


Figure 7-4 Concept JPI Urban Europe project CODAloop 2019 Source CODAloop (2019)

WHY? Current governance structures and processes are often challenged, as new types of collaboration and learning are tested in the often rather experimental setting of such projects. By bringing urban actors, stakeholders, civil society and so forth, together to jointly work on a specific topic, **demonstrations or pilots allow the development of new urban collaborative governance concepts and policymaking frameworks**, besides new approaches to urban planning and development, based on productive and creative stakeholder engagement. This collaboration must to be widened and consolidated for several reasons:

Integrated and functional long-term governance structures need to be maintained beyond the project's end. Experimental projects provide a framework for collaboration of various administrative sectors and departments, businesses, research institutes and civil society. Within the projects, an environment which allows participants to jointly discuss and exchange has been created and a local ecosystem with new connections and networks has been formed.

Experimental projects provide the testing ground to create evidence with foreseeable risks. A major advantage for public agencies of demonstrations or pilots is that the risks the experimenting comes with, can be taken and tested on the scale of a (often subsidised) project. Narratives behind the project, coupled with facts and figures, provide the ground for identifying the public value of the project and contribute to trigger decisions and investments for the replication and scaling up of the results and processes of demonstrations or pilots**.**

The openness of the current governance regimes to experimentation is essential. The level and depth of experimentation is closely connected to the specific type of governance setting, flexibility and openness to new approaches and processes. In some European countries, city administrations and public bodies have a tradition and openness towards experimentation and the acceleration of the results while in others these approaches are very new.

What is more, **participation through co-creation precedes in many cases more formal collaboration**. Today, it is widely acknowledged that real participation of citizens, organisations and other urban actors, is essential for experimental urban research and innovation projects as well as for urban transition to a more sustainable and resilient future state (JPI Urban Europe, 2018; EIP-SCC, 2016). Participation should be taken seriously and should start right from the beginning of a demonstration/pilot/project/urban living lab having the prospect of acceleration in mind.

Creating ownership of all stakeholders and people involved in a dedicated process, sets cornerstones for later acceleration of the impact that was generated in an experimental smart, sustainable cities project. Bringing all stakeholders together from the beginning, collecting their ideas and listening to them while explaining the objective of scaling up or replicating the results at the end of the project right, is crucial. A moderated and clear process must be set up, in which the acceleration of the impact generated in the demonstration or pilot, is stressed right from the start of the project. Participating citizens are experts in their living environment, street and neighbourhood. Therefore, **both individuals and associations can act as multipliers**, who are widening the circle of engagement. This leads not only to a better understanding of complex settings and contexts, but it also generates more robust and innovative knowledge, and forges better connections between social and technical developments in cities.

TO DO 4: PERFORM A VIABILITY ASSESSMENT

of applied methods and solutions for other projects and contexts, and do a risk assessment of key success factors

Probably, the successful implementation of the demonstration or pilot will draw the attention of other parties interested in repeating the demonstrated solutions in other places and in other situations. However, as **solutions cannot be simply copy-and-pasted**, for the next TO DO their applicability and viability in other contexts should be assessed, and key success factors must be compared with the new situation before the plan is prepared.

EXAMPLE: SELF-ASSESSMENT METHOD FOR REPLICATION One of the first steps and key requirement for becoming a Smart City is to set up an effective and ideally permanent City Governance involving all city relevant departments (Energy, Mobility, ICT, Waste management, etc.) as well as key community groups (utilities, industry, SMEs and start-ups, research organisations, NGOs, citizen associations). The governance aims to facilitate communication and collective thinking across municipal sectors and between the municipality and the local community, thereby breaking static silo approaches, and disconnection from society, and unleashing strategic, integrated and synergetic smart city planning. In this context the notion of "cooperation" gains relevance. Generally speaking, cooperation can be interpreted as working together with a common purpose and toward a common benefit. In RUGGEDISED, ISINNOVA a specific methodology was developed for the evaluation of the perceived level of *cooperation* inside each City Governance and the improved *capacity* acquired by its members. It is a useful method to assess the "effective" functioning of the group and to identify potential "weak points" for future improvement. The method is a self-assessment process carried out directly by the staff of each Fellow City, with ISINNOVA providing assistance and guidance in the use of the method and interpretation of the results.

LEVEL OF COOPERATION In RUGGEDISED, the "level of satisfaction with cooperation" is closely monitored. To be able to assess and quantify this qualitative indicator in the best way, the project built upon the work carried out by the project CITYKeys, which compiled a complete and exhaustive set of KPIs, and further developed and validated a custom-tailored set of KPIs to allow for common monitoring and comparison of smart city solutions across European cities. Focus was on the following six indicators, adapting them to the specific needs of the RUGGEDISED work: **Leadership, City Departments Involvement, Balanced Project Team, Clear Division of Responsibility, Stakeholders Involvement, Interoperability.** The **level of cooperation within City Governances** can be quantified by **combining these 6 dimensions:** the assumption is that the more successful they are, the higher the level of cooperation will be. KPIs are assessed via ad-hoc questionnaires created by ISINNOVA and submitted to the members of the City Governances *core teams*, *expert groups* and *decisions groups* (these are the three key bodies which were adopted by the Fellow Cities to foster the work of the respective City Governances), as well as with other relevant community stakeholders involved in the joint execution of the Smart City Replication Plans of Brno, Gdansk and Parma. The assessment is executed in **two specific moments in time:**

- At the beginning of the project, in order to build a **baseline** and an **ex-ante evaluation of city expectations**;
- At the end of the project, when an **ex-post evaluation** and a comparison with the ex-ante expectations and across the three Fellow Cities will be done. This will in turn allow to identify the main barriers and success drivers to improve cooperation.

SMART CITY CAPACITY LEVEL Similarly, a self-assessment on the governance capacity level is performed at the beginning of the project on the following horizontal dimensions (see EIP-SCC, 2013):

Decisions:

- **Policy and Regulation:** creating the enabling environment to accelerate improvement.
- **Integrated Planning**: working across sectors and administrative boundaries and managing temporal goals.
- **Citizens Focus**: involving citizens in the process as an integral actor for transformation.

Insights:

- **Knowledge Sharing**: accelerating the quality sharing of experience to build capacity to innovate and deliver.
- **Metrics and Indicators**: enabling cities to demonstrate performance gains in a comparable manner;
- **Open Data**: understanding how to exploit the growing pools of data; making it accessible- yet respecting privacy.
- **Standards**: providing the framework for consistency commonality and repeatability; without shifting innovation.
- **Foresight**: understanding how to develop long term smart city visions, roadmaps and plans using participatory foresight methodologies.

Funds:

- **Business Models, Procurement and Funding:** identifying sustainable models and integrating local solutions in an EU and global market.

WHY? As cities are complex and highly dependent on local characteristics, scaling up and replication of demonstrations and pilots is a tricky but important issue. On the one hand, the settings and circumstances in such sometimes experimental projects are specifically arranged for the course of the project and might not necessarily fully reflect the urban realities. On the other hand, **plans and activities might be dedicated to the characteristics in one particular city**, district or neighbourhood making the direct application in another setting difficult. As pointed out earlier in section 7.1, because the local characteristics determine the translation of results, findings, and so forth, into another urban context, it is useful to mention the framework conditions influencing these processes for enhancing the impact of the demonstration or pilot from the development stage on. In practice the interplay of the various framework conditions for business models, participation and governance, determines whether, and how far the current urban system is able to take up new results and solutions (EIP-SCC, 2013).

TO DO 5: ADJUST APPLIED METHODS AND TECHNOLOGIES

towards local situation and conditions, and to foreseeable changes in future

Subsequently, the next TO DO is that the **original plan and project features must be made replication and future-proof**, by adjusting it to other local situations and conditions, and to expected changes in future.

EXAMPLE: URBANIST STUDY ŠPITÁLKA

The City of Brno launched an urban design competition for its replication area. The task for the participants in the International Open Urban Design Idea Competition for Špitálka was to convert a part of the unused premises of the Brno district heating plant and the surrounding area into a smart city district. The results were approved by the Brno City Council on Wednesday 20 March 2019. The competition designs also had to take into account several principles of Smart Cities, making the new neighbourhood environmentally friendly and self-sufficient as regards energy consumption. The objective is to verify new technologies and innovative approaches that could subsequently be expanded also to the rest of Brno. The Špitálka district could thus serve as a testbed for further city development. The competition was announced as an idea competition. Thus, the City of Brno now can use the ideas of the highest-appraised proposals (not only the winning one) for commissioning a planning study of a broader territory. This will then be used for an amendment to the Master Zoning Plan of the City of Brno and for the very construction and revival of this part of the city.

WHY? As mentioned in section 7.1, it is **hardly ever possible to just copy-and-paste specific solutions** to other situations and contexts. Therefore, a profound review of the original plan of the demonstration project is necessary: which adjustments and fine-tuning are necessary to achieve the aims of the new project?

Based on these outcomes, other cities and stakeholders can **set up new projects**, adapted to local situations and context.

TO DO 6: CONSOLIDATE A PIPELINE OF NEW PROJECTS

in other cities with other contexts and local specificities

EXAMPLE: REPLICATION IN PRACTICE WITH A PASSIVE CITY HALL IN SERAING

The passive city hall of Seraing is part of a global reflection on the requalification of an 800 hectares' zone in the city. This area, hard hit by the steel crisis, has been the subject of a vast program of studies on a magnitude never seen before in Belgium. All the actions were completed by a town planning study, the result of which gave birth, in 2006, to the **Master Plan** of Seraing. Among the priority intervention zones identified, the regeneration of the city centre as well as the construction of a new City Hall, were the first step towards the redevelopment of the city.

Figure 7-5 New City Hall in Seraing

The construction of this new building is also part of a sustainable development objective that supports the commitments made by the City of Seraing in the framework of the Covenant of Mayors through its **Climate Action Plan**, adopted in 2015, to reduce the CO_2 emissions to 20% by 2020. It is from this perspective that the city has opted for a passive building, at the forefront of technology, home automation and construction techniques. The main objective is to **reduce the consumptions by 80%** previously measured using the old, expensive, and energy-consuming buildings disseminated in the city. The new City hall of Seraing is the **first and largest (6,345 m²) public building to be certified passive** in Wallonia. It has been inserted into a public space that has been entirely redesigned. In addition to building performance objectives and passive certification, other objectives have been achieved, that makes it a replicable model across other European cities: a **significant financial gain** through reduced energy bills compared to old installations and travel minimized by bringing together many city departments, an **ease of maintenance** and operation of the building, the beginning of the regeneration of the city centre as the city is keen to encourage private investment via a newfound attractiveness.

The high performance represents an average **saving of € 40,200 per year**, as well as an avoided emission of 148 tonnes of CO_2 per year, compared to a new building that strictly complies with current standards. The construction of the City hall has been the subject of a loan of € 10 million contracted by the City of Seraing and supported by an alternative financing of Wallonia of € 7.8 million.

7.4 Inspiration

Anticipating constraints on upscaling

(Marc Dijk, University of Maastricht)

Many current experimental smart city projects consist of small-scale performance tests and technology-user interactions, often neglecting the larger social-institutional context. Therefore, successful implementation of new practices in the reality of a *Living Lab* does not warrant broader adoption outside the lab (i.e. 'upscaling'), required to reach their full innovative effect. Another limitation is its focus on "smart citizens" as users and partners, namely citizens with both the cognitive and material resources to consume and co-produce the smart services. Citizens lacking these resources will normally not be included as co-creators in *Living Labs*, nor are they likely to be able to make use of the smart services once these are implemented on a larger-scale. The consequences may not only be poorer design of smart technologies or their limited adoption and use, but also social exclusion, i.e. deprivation of part of the population from new services.

Photo credit: Synlig Design/Erik Børseth

The SmarterLabs project (SmarterLabs, 2019) has developed practical ways to effectively anticipate these two limitations in the Living lab approach. The tables below discuss ten typical constraint on upscaling or social inclusion and offer ways to anticipate them.

The SmarterLabs projects tested these guidelines in action research in four cities in Europe (Brussels, Graz, Bellinzona and Maastricht). For instance, in Maastricht one constraint on upscaling inter-modality is high institutional fragmentation, in the sense that **key stakeholders** (residents, commuters, businesses) **normally do not meet and discuss** on these matters in an organized way, although probably have very different views on this. Typically, the municipality **bi-laterally** speaks to business actors and citizens for policy input. The participatory vision and assessment experiment that was organised, was designed to help to anticipate this constraint on upscaling smart inter-modality. In two sessions **the stakeholders came together in both a plenary meeting and sub-group meeting**, and the diverse visions were developed, presented, discussed, assessed, re-developed in an open and mutually inclusive way.

Table 1 Typical Constraints in Living Labs experiments (Source: SmarterLabs, 2019)

TYPICAL CONSTRAINTS IN LIVING LAB EXPERIMENTS				WAYS TO ANTICIPATE THESE CONSTRAINTS
SOCIAL INCLUSION	*Exclusion **FROM THE Living Lab***	#1	**Citizens lack financial, intellectual and time resources to participate in the Living Lab** *To participate meaningfully, citizens need time, energy and commitment, a certain level of understanding of the issue at stake or of the technology in use, and sometimes also specific economic and intellectual resources or skills. Certain social groups may therefore tend not to participate in Living Lab initiatives.*	• Apply stakeholder and requirement analysis tools (in relation to desired outcomes of the Living Lab) to identify types of exclusion, their motivations and coping strategies • Include all Living Lab participants in such a reflection (not only the "institutional" initiators), across the Living Lab stages • Strategically design Living Lab micro-practices, such as informative and educational material, choice of venue and schedule of meetings, language, provision of technological support to reduce digital divide
		#2	**Relevant stakeholders remain out of the Living Lab** *Certain groups might not be interested in joining Living Lab activities, since they do not share the urgency to discuss the issues at stake and take action, or even have conflicting attitudes or goals. The Living Lab may thus become a low conflict circle of people sharing priorities, attitudes and goals, while the large majority of citizens would ignore it.*	• Stakeholder analysis allows to identify the relevant target groups and the reasons why they might/might not be interested to join Living Lab activities • This suggests how to frame Living Lab activities in public communication campaigns aimed at recruiting participants and to identify the specific actions needed to also raise the interest of less intrinsically motivated target groups
		#3	**Groups and impacts outside the Living Lab context are overlooked** *The Living Lab project may lack or be poor of representatives from the larger urban context, though they might be impacted by the project. Likewise, effects beyond the Living Lab boundaries may be neglected (e.g. decrease of cars in one district shifts traffic to another).*	• Explicitly consider the project's indirect and cross-scale effects in the broader urban context, by reflecting on the multiple scales relevant to the Living Lab and on the actors that might be included/excluded at each scale • Adopt adequate logistic arrangements and outreach strategies to help minimize exclusion, such as convening Living Lab meetings at different locations and being open to reframe meetings to achieve a shared vision and increase motivation
	*Exclusion **IN THE Living Lab***	#4	**Existing power structures are reproduced inside the Living Lab** *The Living Lab setup and applied methods may not guarantee that any group or participant has equal opportunities for participating in the discussion, so that every voice is heard and seriously taken into account. For example, the Mayor, technical experts, or simply male Living Lab participants, may be given more weight than other participants.*	• Regularly perform a stakeholder group dynamics analysis, in order to understand group structure and leadership relations among group members • Particularly, identify any dominant position among Living Lab participants, due to already existing institutional roles outside the Living Lab (political responsibility, lobbying activity) • Design a communication and management strategy to address all identified target groups, keep flexibility, favor development of activities along different tracks, allowing each group to adapt to their speed of progress
UPSCALING	*Related to **Living Lab DESIGN***	#5	**The Living Lab's potential for learning is underexploited** *If the lessons offered by Living Lab activities are not explicitly monitored, understanding of the innovation process, of its implications and its consequences, may be low. In this case, only limited transfer of learning is possible, thus precluding the diffusion of innovation across spatial scales.*	• Develop a comprehensive learning strategy aimed at capturing and monitoring knowledge creation in the Living Lab (collective knowledge co-production) and transferring it to all relevant actors outside the Living Lab • Knowledge exchange can be favored by people-to-people real-life interactions (i.e. physical meetings), which make learning more rewarding and comprehensive to all and also ensure tacit knowledge to emerge
		#6	**The Living Lab is disconnected from broader societal debate** *The Living Lab experiment may lack co-ordination with the social, economic, cultural and political conjuncture. In such a case, the policy climate may not support the adoption of the innovation pursued in the Living Lab. The broader public may either not share the Living Lab's goals and outcomes or find them irrelevant.*	• Design and manage Living Lab activities with great care for the local conjuncture: consider broader socio-economic, cultural and political aspects, ensure links with the existing public debate, with what a community considers to be its priorities, and what stakeholders consider to be feasible • Maintain a certain flexibility throughout the Living Lab, be ready to adapt to changing conditions in the outside social and political agenda. Ensure that both Living Lab objectives and its framing can be adjusted and continuously re-defined by all actors • Place citizens at the core of the process and actively coordinate with other societal developments and initiatives related to the content of the Living Lab

TYPICAL CONSTRAINTS IN LIVING LAB EXPERIMENTS				WAYS TO ANTICIPATE THESE CONSTRAINTS
UPSCALING	*Related to* ***CONTEXT***	#7	**The Living Lab consensus is not reflected in policy and society** *Even if the topic addressed by the Living lab is a priority of the social and political agenda, persistence of conflicts on specific topics may preclude reaching agreements, either inside or outside the Living Lab. The outcomes of the Living Lab may therefore lack wide consensus, support and political majority.*	• Open to participation as much and as early as possible and regularly update the stakeholder analysis whenever external conditions change, in order to avoid the exclusion of any relevant stakeholder group • Favor emergence of any conflicting goals within Living Lab participants and between Living Lab participants and possible external stakeholder groups not actively engaged and manage conflicting goals by multi-criteria decision-making techniques • Always emphasize and give weight to potential community-level benefits of the options under discussion, against personal or partisan benefits. To this purpose, exploit already existing networks and coalitions and seek for new and unexpected alliances between groups of stakeholders, trying to build relationships with successful initiatives already developed by other actors
		#8	**Stakeholders and institutions are highly fragmented** *Fragmented institutional arrangements between and within institutions ("silo compartments") may preclude clear distribution of responsibilities among the actors involved in Living Lab activities, and effective co-operation between them.*	• Foster transparency and collaboration between administrative units, organisations and stakeholders, right from the beginning of the Living Lab process • Create occasions for them to interact and become familiar with the process, discussion topics and proposals emerging within the Living Lab
		#9	**The urban assemblage is sticky and locked-in** *Technical, infrastructural, legal or financial aspects, such as long-term contracts or legal lock-ins, may cause obduracy of the urban assemblage, thus precluding possibilities for practical implementation of the outcomes of the Living Lab.*	• Activate a dialogue with relevant actors as soon as possible: by developing future visions with stakeholders and crucial decision-makers, the potential of more structural changes can be highlighted • Local actors might be empowered by teaming up with supra-urban actors, such as municipalities with provinces or local NGOs with their national counterpart (scale jumping)
		#10	**The Living Lab meets low institutional receptiveness** *Local governments and other actors involved in the Living Lab process might be unfamiliar with, or open to, co-creation approaches, favoring instead expert-driven way of thinking and agreement with powerful lobbies. If so, institutions may not have real commitment to implement Living Lab outcomes.*	• Seek for early inclusion of policy-makers and local institutions • Provided that Living Lab organisers show genuine commitment and give voice, role and responsibility to diverse groups of citizens, civil society organisations and experts, institutions might start appreciating the approach and its benefit • Carry out multiple successful pilot processes • Build on existing practices and procedures of representative democracy to promote dialogue between stakeholders

CONCLUSIONS AND NEXT STEPS

A few years ago, in the Action Cluster Integrated Planning, Policies and Regulatory Frameworks of the EIP-SCC, it was felt that there is a huge amount of relevant information around on smart cities and low energy districts. Nevertheless, due to a lack of resources and time pressure, many city administrations hardly seem to have the opportunity to access this information and translate it to suit their own situation and ambitions, resulting in the frequent re-inventing of the wheel. Would it be possible to develop simple guidance material, that would take city administrations and their stakeholders through the pitfalls and barriers of setting up such projects, and present some ideas about how to prevent or overcome them?

Soon the idea emerged to develop an **easily accessible guide for all city administrations** that might be interested in orientating themselves and forming an opinion about what would be useful for them, by supporting their ambitions to make their cities more sustainable, competitive, inclusive, and having a higher quality of life, with the help of smart city and low energy district solutions.

This guidance material should essentially be **a self-help guide**, getting city administrations started, preceding the bigger work. Its scope should be rather superficial, because detailed information is available through excellent repositories as SCIS. Besides, the document should not become an encyclopaedia. It should provide a recipe for preparing and realising plans in an integrated way: cross-domain and multi-sectorial, having a pervasive long-term perspective on the built environment, not going the road alone but being inclusive and co-designing the solutions with businesses, research and citizens. The guide should be complementary to information about specific technologies and offer ideas for organising the „soft shell" around implementation of these smart city and low energy district technologies. And lastly, it should be as practical as possible.

The work was started with making an overview of obstacles or barriers and how to solve or overcome them, and an **intermediate version** was published in June 2017 (Borsboom et al., 2017). However, important feedback was that more structure was needed to serve as guidance material. As a result, the document gradually morphed over the years into a roadmap containing specific steps for integrated planning and management of smart city and low energy district projects. The eea – European Energy Award - method proved to be a good basis for this. More information about how the material has been collected can be found in Annex 2.

Three years later, the **final version is here**. Testbeds in and interviews with follower cities and other cities planning smart city and low energy district projects, have made clear that the SCGP can play an important role by making cities and urban stakeholders acquainted with the path ahead, mindful of the preconditions to be fulfilled for successful implementation and replication, and aware of where relevant information on experiences and best practices can be found. In this capacity, the SCGP can contribute to better integrated planning and management of smart city and low energy district projects in the future and accelerate the uptake of smart city and energy-efficient solutions, both in terms of appropriate methods as in terms of suitable technologies.

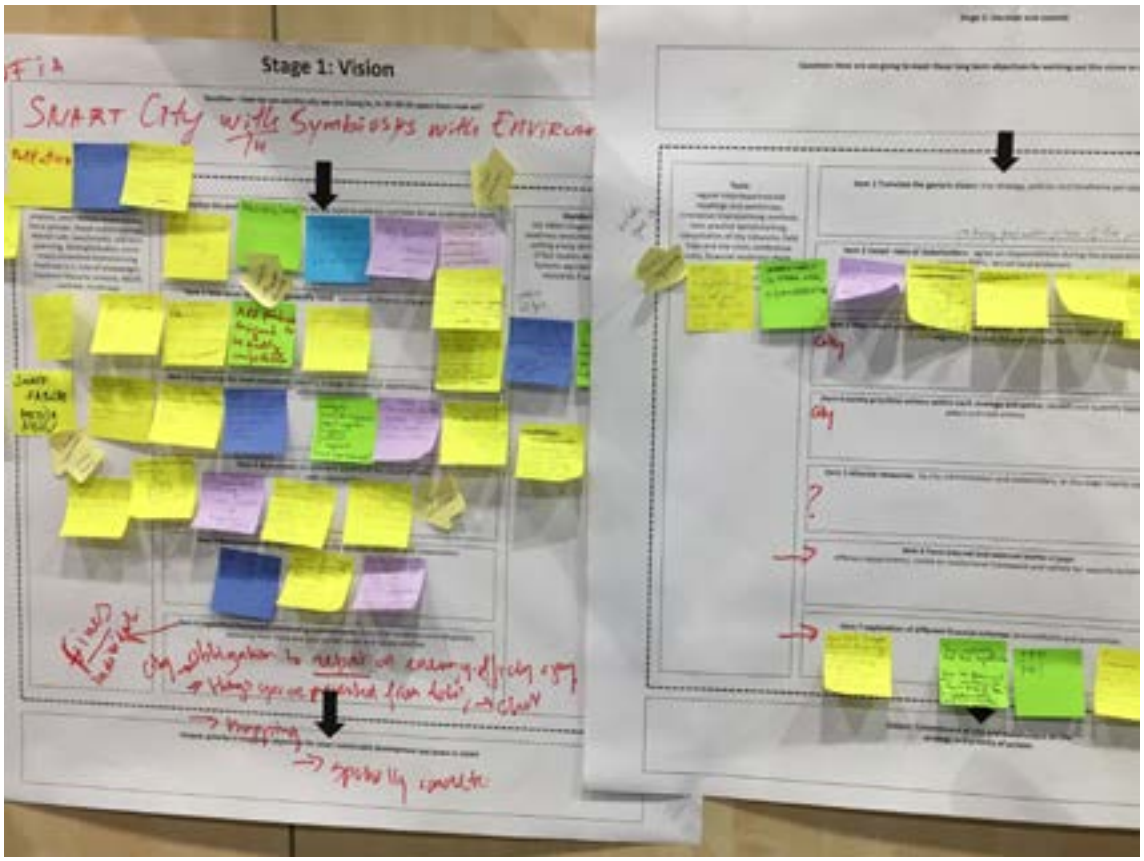


Figure 9-1 Results of a testbed of the SCGP in Sofia

While this document was drafted, it has tried to have the **perspective of the intermediary:** processing information from one practitioner to pass it to the other. This means that its content could not have been developed without the willingness of dozens of practitioners and experts to share this information. City administration staff, consultants, businesses and research candidly expressed their views – about what works but also about what does not work. Apart from that, small talk and site visits demonstrated the immense proudness of practitioners about what had been achieved in their city and the heart-warming enthusiasm of residents and businesses about these new, innovative developments.

Since the first work on the SCGP was started in 2016, the smart city and low energy districts landscape has changed. The first generations of Horizon2020 SCC-01 projects have finalised their implementation phase. More cities are working on SE(C)APs and eea plans. JPI Urban Europe funded 17 smart city projects where living labs play a central part and published a new Strategic Research and Innovation Agenda. CEN/CENELEC/ETSI work on smart cities standards has progressed. All in all, this means a vibrant community has come into being, where SCIS is key to store and disclose experiences and build a collective memory. Many city administrations and politicians realise that better interconnections and cross-domain thinking are essential for meeting the challenges cities are facing. Not only at EU level, but also at national, regional or local level. Collaboration between city administration, research, businesses and citizens has become mature and better documented.

The IPCC report published in Autumn 2018 makes clear that work on climate and energy must be stepped up, as only a 12-year time-window is left to prevent worse (IPCC, 2018). It is widely acknowledged that a fundamental energy transition in cities is needed, and that this will influence how we design, use and operate our built environment. We hope the SCGP contributes to this transition, no matter how small, by paving the road for a more widespread use of smart and energy-efficient solutions which contribute to more sustainability and quality of life.

The journey has not yet come to an end, and there is always room for improvement. For that reason, the following steps are considered for the near future:

- Summary for politicians of the main steps and uses of this roadmap in a brochure;
- Development of an Open Access web-based version under a Creative Commons license;
- Establishment of a proper linkage to SCIS;
- More collaboration by teaming up with adjoining initiatives, such as Covenant of Mayors for Climate and Energy, eea, JPI Urban Europe, and CEN/CENELEC/ETSI Sector Forum Smart and Sustainable Cities and Communities. How can different methods and tools reinforce each other? Which activities can be organised together with the EIP-SCC?
- Inclusion of more material about the actual implementation of plans;
- Testing and evaluation of this version. Does it really work as a self-help guide? What information is still missing? Could it provide a basis for technical assistance?
- Better linkage to specific phases in decision making in the built environment – when does it make most sense to have this type of information available – and how can this instrument help to de-risk investments and pave the way for better business models or provide better access to financial sources?
- Analysis of the influence of local conditions and contexts on the applicability of the SCGP;
- Explore the usefulness of this roadmap tool for adjoining topics, such as nature-based solutions and circular economy

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ANNEX 1 SEAP PROCESS

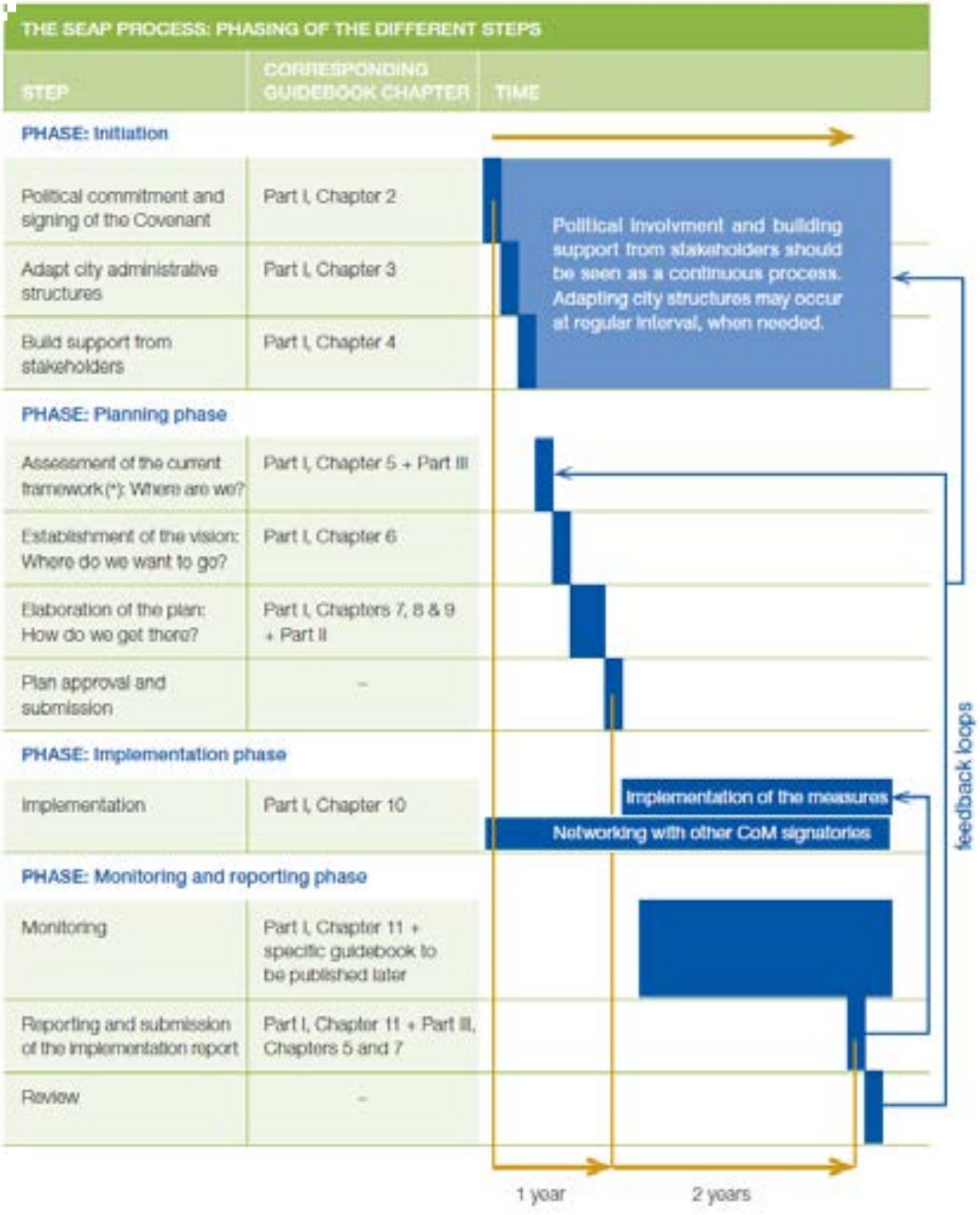


Figure A1-1 The SEAP process: phasing of the different steps. Source: Covenant of Mayors for Climate and Energy

Figure A1-1 above summarises different steps in the process of initiating, drafting, implementing, monitoring and reporting of SEAPs or SECAPs.

ANNEX 2 APPROACH AND GATHERING OF INFORMATION FOR THE SCGP

Several workshops and meetings have been organised between 2016 and 2019 involving commitments in the EIP-SCC Action Cluster IPPR and other public authorities, businesses, and research institutes, for the initiative "From Planning to Implementation and Upscaling of Smart City projects", led by Judith Borsboom and Margit Noll. Among these meetings were most relevant:

- EIP General Assembly, May 2016 in Eindhoven
- Nordic Edge in Stavanger and EIP-SCC Action Cluster meeting, both September 2016
- Smart City Expo Barcelona, November 2016 in Barcelona
- Nottingham Study Tour, March 2017 in Nottingham
- EIP-SCC General Assembly, June 2017 in Brussels
- Nordic Edge conference in Stavanger, September 2017
- Review Meeting at DG-Energy, October 2017 in Brussels
- EIP-SCC General Assembly, June 2018 in Sofia
- Action Cluster IPPR meeting October 2018, in Brussels

Topics explored during these workshops were phases of implementation, key stakeholders and their roles, common pitfalls and barriers during planning and implementation, innovative solutions and best practices, the role of standards, and how to ensure replication and upscaling. Based on the outcomes of these workshops, a preliminary outline for the SCGP was developed. This outline was subsequently filled in with a desk and literature research on phases of implementation and obstacles for implementation and replication, solutions, actors and their roles. Nearly 50,000 FP7 & H2020 projects were scanned in order to find the relevant ones to connect and delve deeper and the SCIS proved to be an excellent source of information (SCIS, 2019

Projects face many issues in different stages of their development. Initially, the focus was on these issues. Specific challenges, obstacles, and barriers were excluded from the analysis if they were relevant only to a particular technology. Projects were excluded from the research sources if they involved only:

- Design, conceptualization, scenarios, methodologies, or other theoretical strategies;
- Metrics, indicators, or standards design, development, or definition;
- Cloud-based solutions;
- Optimization, modelling, or management approaches;
- Framework, platform, software, or app development;
- Development, refinement, or marketing of private products.

Remaining projects that may have been relevant but that provided no website, deliverables, or project material access were also excluded. Categories of issues from planning to implementation were originally adapted from content in (Di Nucci et al., 2010) and (Wnuk et al., 2010) with inputs from (CoMO, 2016; SCSP, 2013a, 2013b), interviews, and workshops.

However, to get more in-depth information on the implementation of smart city projects and the needs of fellow or follower cities for further development of content for the SCGP, a more detailed understanding was needed. Therefore, city representatives, projects managers and researchers, in particular of SCC-01 lighthouse projects, were contacted and about 25 were interviewed, many of them implementing lighthouse projects or participating as follower or fellow city. These key players were asked to define and illustrate phases of implementation, and to map relevant actors and their specific roles. In addition, they

were requested to provide details on obstacles and on solutions that had helped to overcome them. Finally, their experiences with replication and scaling up were discussed. Confidentiality of interview outcomes needs to be guaranteed to get usable outcomes. Privacy issues were protected by rules of the NSD – Norwegian Centre for Research Data.

Besides, through ERANET and JPI Urban Europe research and innovation funding calls, 17 additional smart city projects are involved, mostly in medium-sized cities, and have substantial findings on replication and scaling up. The Action Cluster IPPR initiative "KPIs and tools for decision making and benchmarking", led by Bernard Gindroz (European Energy Award-eea-, CEN/CENELEC, ETSI), has bundled experiences and best practices in the field of roadmap development, monitoring and standardisation, in particular on the methods used by eea.

The findings were discussed with lighthouse and fellow cities, ICLEI and Eurocities city networks, and SCC-01 project managers, and enriched with their feedback. This resulted in the first version of this SCGP (Borsboom-van Beurden et al., 2017).

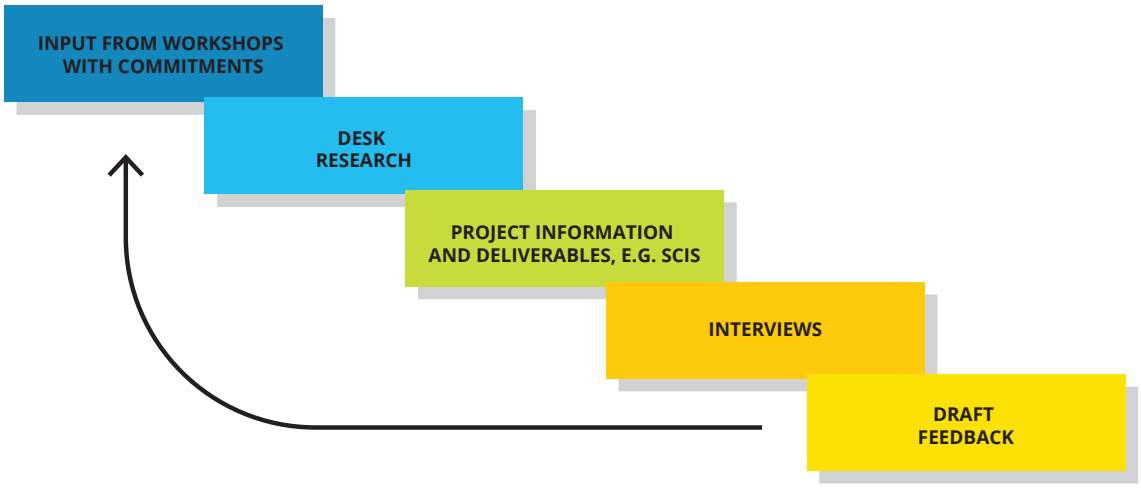


Figure A2-1 Development of the SCGP

Based on conclusive arguments brought forward by the participants of the DG-Energy hosted workshop October 2017 in Brussels, it was decided to add more information about the steps in developing smart city plans and their subsequent trajectory, not only towards implementation, but also towards monitoring, replication and scaling up. Main content of the SCGP was reorganised, additional interviews were conducted, and more material collected on examples. Besides, a more in-depth study of the eea method took place. Eventually, all these inputs were combined in this novel methodology for developing a coherent roadmap for integrated planning and implementation of smart city projects that is at the heart of this guidebook, and a pre-test version was finalised in November 2018.

Following, between November 2018 and February 2019, five testbed workshops were organised in fellow cities from SCC-01 projects IRIS, SmarterTogether, and Ruggedised: Santa Cruz de Tenerife, Sofia, Vaasa Brno and Parma. During these workshops, participants were invited to propose actions the city and its local ecosystem could take during each particular stage of the roadmap. Evaluation rounds at the end of each testbed session provided invaluable material for improving the SCGP in terms of language and terminology, order of topics, density and comprehensibility of information, and so forth. Early 2019, these comments and advices have been used to update the content and style with the present result. Crucially, without these five fellow cities and their stakeholders willing to spend time, and share their needs and ideas, it would have been impossible to increase the quality of the document, and the authors are immensely grateful for these opportunities. Main changes since then have been the combination of all introductory texts in one big pre-chapter, an improved lay-out of steps per stage in form of checklist with to do's, a reversed order for all barriers and solutions, more examples added, and a heavy redaction.

Figure A2-2 Testbeds in Santa Cruz de Tenerife (23 November 2018), Sofia (26 November 2018), Vaasa (4 December 2018), Brno (30 January 2019), Parma (8 February 2019)

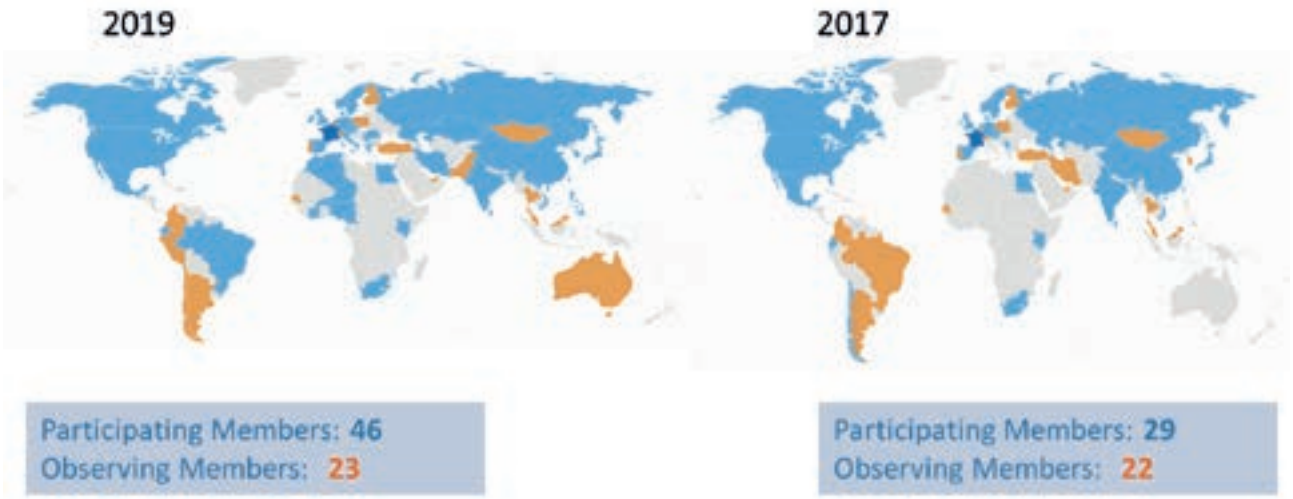
ANNEX 3 COMMITMENT TO STANDARDS

Standardization is a key contributor to boosting the implementation of sustainable related actions for meeting these strategic objectives.

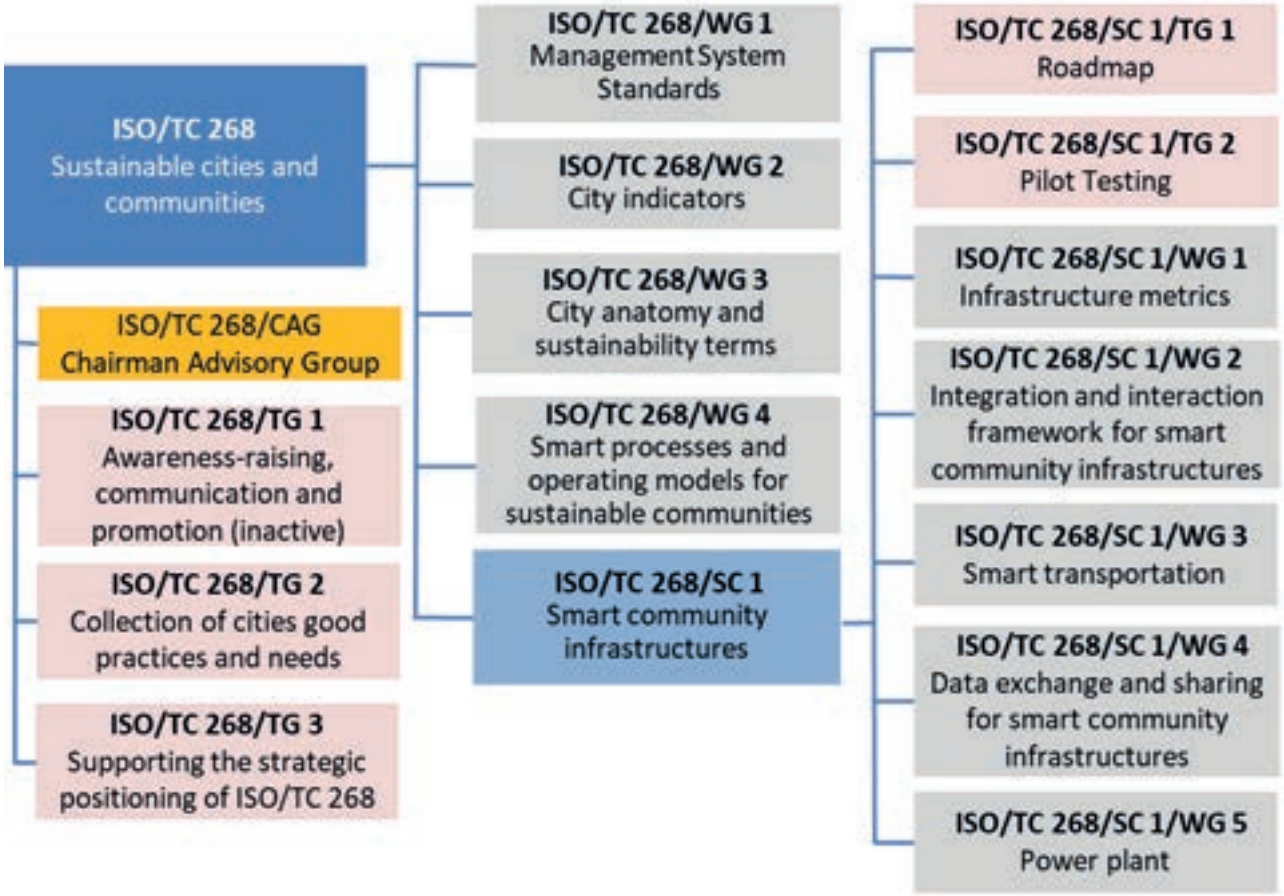
Standardization is an efficient way to harmonize methods and evaluation protocols, as well as to define **KPIs** and the way to calculate/evaluate their values. Implementing standards help in **aligning** initiatives and ambitions, as well as in considering a whole set of common issues and in using common methods for KPIs' calculation/definition and for **monitoring**, which is key for feeding a **benchmark** of best practices and success stories based on values.

Smart cities related standardization developments are conducted at global level (ISO, IEC, and ITU) as well as at European Level (CEN, CENELEC and ETSI). **Sustainable development in cities and communities** related standardization developments are mainly conducted at global level by the ISO Technical Committee on sustainable cities and communities, ISO TC 268, where management system standard has been published – ISO 37101 -, as well as KPIs related ones – ISO 3712x series – and infrastructures related ones – ISO 3715x series-.

ISO TC 268 has 69 members (countries), 46 being active ones and 23 observing ones. All continents are represented. The participation in the standardization development of ISO TC 268 is increasing rapidly, with direct inputs from cities. This contributes to ensure standards are developed by cities for cities, with the right level of details. The below figure shows the evolution of the membership between 2017 and 2019:



ISO TC 268 is organised with several Working Groups to meet the cities' expectations and with permanent relation with the management system (holistic) approach. The figure below presents this organisation:



Further information can be found on the ISO TC 268 webpage, https://www.iso.org/committee/656906.html

The following figure sum-ups the standardization developments made by the ISO TC 268 in support of the set of sequences as described in the SCGP.

The following table give the list of standards developed in ISO TC 268:

ISO 37100:2016	Sustainable cities and communities -- Vocabulary
ISO 37101:2016	Sustainable development in communities -- Management system for sustainable development -- Requirements with guidance for use
ISO 37104	Sustainable cities and communities -- Transforming our cities -- Guidance for practical local implementation of ISO 37101
ISO 37105	Sustainable cities and communities -- Descriptive framework for cities and communities
ISO 37106:2018	Sustainable cities and communities -- Guidance on establishing smart city operating models for sustainable communities
ISO/DTS 37107	Sustainable cities and communities -- Maturity framework for sustainable and smart-enabled communities
ISO 37120:2018	Sustainable cities and communities -- Indicators for city services and quality of life
ISO/TR 37121:2017	Sustainable development in communities -- Inventory of existing guidelines and approaches on sustainable development and resilience in cities
ISO 37122	Sustainable cities and communities -- Indicators for smart cities
ISO 37123	Sustainable cities and communities -- Indicators for resilient cities
ISO/TR 37150:2014	Smart community infrastructures -- Review of existing activities relevant to metrics
ISO/TS 37151:2015	Smart community infrastructures -- Principles and requirements for performance metrics
ISO/TR 37152:2016	Smart community infrastructures -- Common framework for development and operation
ISO 37153:2017	Smart community infrastructures -- Maturity model for assessment and improvement
ISO 37154:2017	Smart community infrastructures -- Best practice guidelines for transportation
ISO/DIS 37155-1	Framework for integration and operation of smart community infrastructures -- Part 1: Opportunities and challenges from interactions in smart community infrastructures from all aspects through the life-cycle

ISO/AWI 37155-2	Framework for integration and operation of smart community infrastructures -- Part 2: Holistic approach and the strategy for development, operation and maintenance of smart community infrastructures
ISO/DIS 37156	Guidelines on data exchange and sharing for smart community infrastructures
ISO 37157:2018	Smart community infrastructures -- Smart transportation for compact cities
ISO/FDIS 37158	Smart community infrastructures -- Smart transportation using battery-powered buses for passenger services
ISO 37159	Smart community infrastructures -- Smart transportation for rapid transit in and between large city zones and their surrounding areas
ISO/DIS 37160	Smart community infrastructure -- Measurement methods for quality of thermal power station infrastructure and requirements for plant operations and management
ISO/DIS 37161	Smart community infrastructures -- Guidance on smart transportation for energy saving in transportation services in cities
ISO/DIS 37162	Smart community infrastructures -- Smart transportation for newly-developing areas
ISO/DIS 37163	Smart community infrastructures -- Guidance on smart transportation for parking lot allocation in cities
ISO/NP 37164	Smart community infrastructures -- Smart transportation using fuel cell LRT
ISO/AWI 37165	Smart community infrastructures -- Guidance on smart transportation by non-cash payment for fare/fees in transportation and its related or additional services

At European level, it has been decided to harmonize the standardization developments between the three European Standardization Organisations (ESOs), CEN, CENELEC and ETSI, by creating a joint dedicated Sector Forum: CEN/CENELEC/ETSI Sector Forum Smart & Sustainable Cities and Communities – SF SSCC-. The aim is to harmonize the development in such a way that a set of consistent and complementary standards can be proposed to cities and communities, as a carrier to success stories' replication and scaling-up. CEN/CENELEC/ETSI SF SSCC also analyses the existing international standards and makes recommendation for adoption at European level, as well as needs for amendments. CEN/CENELEC/ETSI SF SSCC is working closely with EIP-SCC, where the major expression of needs from cities and communities, including private sectors and citizens will be collected to feed EU standardization development as an answer to these needs.

In addition, the Sector Forum will consider the outcomes from all relevant EU initiatives (such as SCIS, CoM, eea) and H2020 projects (such as Citykeys, Lighthouse SCC1, Espresso), as well as existing references to standardization works and related documents (such as EU standardization annual work programmes, UN Habitat, UN SDGs, UNEP, UNCCC). In addition to EU priorities and commitments, UN SDGs is a priority which the Sector Forum includes with high consideration in its recommendations for further standardization developments and/or adoption of existing standards, in order to support cities and communities regarding fulfilling the commitment to UN SDGs.

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